KEY ISSUES IN THE APPLICATION OF
KNOWLEDGE MANAGEMENT IN EDUCATION

THESIS

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Abstract

Today's world is a fast moving place where decisions are made with an ever-increasing speed, and the success of an organization rests on its ability to correctly make these decisions. This shift in paradigms has made knowledge the key resource as organizations shift their focus from natural resources to intellectual assets, heralding the use of a concept called Knowledge Management.

Despite its acceptance and use in commercial and government organizations, KM is still not being applied in the academic world. No examples or KM models exist for educational use, and no other studies into this topic can be found. This effect is called the "Shoemaker's Paradox" and reflects the fact that the actual application of a discipline or field of study is often outside of their own realm. In essence, the shoemaker's family does not have a decent pair of shoes.

Given this background, this research attempted to establish a foundation for future research by answering the question "What does current literature identify as the key issues in the application of KM concepts in education?" Forty-eight key issues were uncovered through review of the literature, each with varying levels of emphasis. Many interesting trends were discovered, including an apparent gap concerning educational key issues.

Further research is required to better define these 48 issues, and to discover the cause of this educational issue gap. The key issues discovered here can also be used to build and test an actual KM model for application in an educational environment.

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For my wife & son

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I. Introduction

Background

Today's world is a fast moving place where decisions are made with an ever increasing speed, and the success of an organization rests on its ability to correctly make these decisions (Nonaka, 1996). Davenport and Prusak (1998: 13) concur with Nonaka:

> In short, companies can no longer expect that the products and practices that made them successful in the past will keep them viable in the future. Pricing pressures leave no room for inefficient production. The cycle time for developing new products and getting them on the market is becoming more and more compressed. Companies now require quality, value, service, innovation, and speed to market for business success, and these factors will be even more critical in the future.

This shift in paradigms has made knowledge the key resource as organizations shift their focus from natural resources to intellectual assets. In addition, the advent of affordable computers and networking systems has enabled the fast and efficient manipulation of information, heralding the use of a concept called Knowledge Management (Hansen, 1999).

Knowledge management (KM) is a complex concept that consists of many different aspects, but can be adequately summarized by the following two ideas. First,

KM consists of “methods or solutions that enable an organization to capture and structure its knowledge assets” (Hwang, 2003: 92). Second, KM entails the ability of an organization to recognize the knowledge buried in the minds of its workers, in order to leverage it to provide a benefit to the organization through better decision-making or as an asset for competitive advantage (Davenport & Prusak, 1998; Nonaka, 1996). This is not a new concept, as KM has been in use for hundreds of years through the passing of knowledge from craftsman to apprentice, but it wasn’t until the 1990s that it started to take hold at the organizational level (Hansen, 1999).

In the realm of Information Resource Management, scholars have been exhorting the benefits of KM and how it can capture and harness knowledge within an organization (Davenport & Prusak, 1998). Ever since Peter Drucker first hypothesized the concept of KM (Drucker, 1993), scholars have been studying and applying these concepts to all aspects of organizations and business. When applied properly, KM can be used to improve efficiency and innovation, garnering a competitive advantage that can be leveraged for profit and success (Davenport & Prusak, 1998). Thanks to the many advances in computers and information technology, more and more organizations are utilizing these KM techniques to capture their corporate knowledge, and improve their processes (Hansen, 1999).

The benefits of KM are not lost on the U.S. Department of Defense (DoD) as they are in the process of transforming the way they fight wars and execute their missions. Just as the commercial/business world is starting to apply KM to their advantage, many units and organizations in the DoD are starting to apply the concepts of KM to improve their processes and to stimulate innovation to affect this transformation (Bartczak, 2002).

The Air Force is following suit with the DoD by initiating a knowledge sharing system through their Air Force Knowledge Now (AFKN) website (Air Force, 2004). It acts as an online warehouse allowing users to communicate, share lessons learned, store, and share information (through the use of communities of practice) from any location with access to the Internet (Air Force, 2004). AFKN also supports a virtual schoolhouse, with over 20 online training courses (Bartczak, 2002). This concept of a virtual schoolhouse brings up the possibility of moving training into the realm of education, blurring the lines between the two.

Despite its acceptance and use in commercial and government organizations, KM is still not being applied in the academic world. This effect is called the “Shoemaker’s Paradox” and reflects the fact that the actual application of a discipline or field of study is often outside of their own realm. In essence, the shoemaker’s family does not have a decent pair of shoes (Oliver, 2003).

The academic world has been touting the value of KM, yet fails to use it in its own realm, the academic setting. It’s time for the academic world to practice what they preach, and start looking at ways to use KM in an academic environment. Unfortunately, very little research has been done in this area. There are no models or examples to follow to assist in dealing with the many possible issues in the implementation of KM in education. Since knowledge is becoming the resource of the future, the importance of creating knowledge through the teaching of our workers becomes vital (Drucker, 1993). Thus, our academic institutions must follow suit with the commercial world and embrace the application of KM methods in their daily processes. This issue becomes even more important when you take into account the rigid culture that often grows in many

academic institutions, especially within DoD training centers, and the subsequent resistance to change (Brown & Duguid, 2002; Owens, 2000).

As a matter of fact, US Air Force (USAF) training centers rely on the principles of instructional systems development to change or update their educational/training procedures (DAF, 1993). This process requires so much time and evaluation that newly designed instructional programs are often outdated before they ever leave the design stage (DAF, 1994; DAF, 1993). Such programs are far too rigid to adequately educate and train today's Airmen for the ever changing, high-pace challenges they will face in our modern world.

In order to be successful in the teaching of our future knowledge workers (both commercial and military), academic and USAF training organizations must apply the concepts of KM to stimulate innovation and process improvement within their own culture. To this end, research is needed to identify the key issues to the implementation of KM in education and learning; in other words, what factors (issues) are considered the most important or have the greatest impact. Once this is done, these key issues can be used to build an applicable KM model for use in a real-world educational or training environment.

Research Questions

1. What does the literature identify as the key issues in the application of KM concepts in education?

2. Which of these KM issues appear to have the most relevance for application in education?

3. Which KM issues appear to have the least relevance for application in education?

Research Approach

An exploratory content analysis will be conducted of all available literature concerning the application of KM concepts in education. This analysis will be used to reveal what KM scholars and experts feel are the current key issues pertaining to the implementation of KM in education. These key issues will be ranked and compared to determine the most relevant KM issues addressed in the current literature.

Benefits/Implications of Research

For many years, scholars have identified the strong need for the application of KM concepts within an organization, and a literature review has uncovered many examples of these concepts successfully applied in the commercial world (Vikas, 2003; Hansen 1999; Davenport & Prusak, 1998). However, very little was discovered citing any educational organizations applying KM practices to improve their education or training systems.

The full impact of KM on education and training are unknown, but its tangible benefits can be deduced through the success of the many other organizations that have implemented KM. Given the amount of time and money the DoD is investing in KM and the importance placed on quality training, the application of KM practices in education becomes an important issue to be addressed, both in DoD and the academic world (Bartczak, 2002). This is especially important for the USAF and the rest or the US military in the context that many terrorists and criminal organizations are starting to use KM to execute their illicit operations (Salisbury, 2003). Understanding the key issues to

its implementation is the first important step in developing a model for future research in the application of KM use in education and training.

Thesis Overview

The remainder of this document will report the efforts to answer the research questions presented in this chapter. Chapter II reviews literature from applicable scholars, which serves as the theoretical foundations of this work. This review begins with, a general review of KM and its core concepts, the benefits of KM, and some of the difficulties of its implementation. Chapter III presents the research methodology used in this research, detailing the method and procedures used. Chapter IV highlights the detailed analysis of the collected data and the findings that resulted from this analysis. From this data, the key issues concerning the application of KM in education will be extracted an analyzed. Finally, Chapter V closes this thesis with the conclusions and recommendations gathered from the research.

II. Literature Review

Background

As stated in the first chapter, knowledge is now the key resource to an organization, surpassing land, labor, and capital. The quickening of the pace of business and the advent of computers has only increased our reliance on timely, accurate knowledge. These facts make the use of knowledge management (KM) vital for any organization, but what exactly is KM?

KM and information systems, as fields of academic study, are relatively new disciplines (Vikas, 2003). Yet, whether we realize it or not, managers and leaders have been relying on KM for hundreds of years. From lessons passed down from parent to child, or trade skills taught from craftsman to apprentice, KM principles and techniques have been in use all throughout history (Hansen, 1999). Without calling it KM, they innately used KM techniques to exploit the experience and know-how of their workers, and to maximize sparse resources (Davenport & Prusak, 1998). The wisdom and insight gained through the study of information and the application of KM is not new, only the tools and processes used to manage our knowledge. Information and knowledge has always been deemed important, but it took a very long time to gather and share it, which limited its usefulness. Now, with the advent of modern computers, more information and knowledge are available than ever before, and KM has once again resumed its critical role in the forefront of our society (Hammer & Champy, 1993).

With this increase in availability and ease of use, knowledge has become the critical factor in the success or failure of an organization (Nonaka, 1995). Knowing more

than your competitor or having more knowledge about your customers or market, is now more important than having the most money, land, or labor (Drucker 1993). Peter Drucker (1993) calls this shift a move toward an information society, a society where knowledge drives the economy.

Data, Information, and Knowledge

The concept of KM is very difficult to define, as there are many applicable definitions. But all these definitions appear to have a common theme based off the hierarchical concepts of data, information and knowledge. Before any study can be performed about the benefits of KM, it is important to properly define and understand these concepts behind KM, their relationship to each other, and their relevance. Each of these concepts, and their explanations are detailed below.

Data

According to Davenport and Prusak (1998), data consist of discrete or objective facts about events. They appear as numbers, letters, or symbols without any context or relevance, and lacking in any apparent structure or meaning. The key element in this definition is that the medium is without context. There is no apparent relevance to data, just raw letters and/or numbers on the paper or computer screen. This is pure data, before any filtering or analysis is performed (Spiegler, 2000). This data can take many shapes or forms, from printed documents and recorded media (audio and/or visual), to output on a computer screen. There is usually never a shortage of available data for use. In fact, our ability to electronically process data (via computers) has created such a glut, that

often organizations simply have too much data to wade through, and end up drowning in raw facts and figures (Davenport, Harris, De Long & Jacobson, 2001).

Information

When relevance or context is applied to data, it becomes information. Information uses combinations of data to associate meaning, to relate the elements of a past event, or provide a record of performance (Spiegler, 2000). Drucker (1993) once stated that information is data endowed with relevance and purpose. While Davenport and Prusak (1998: 3) call information, “data that makes a difference”. These three separate views all gravitate toward the same meaning, that information is data endowed with relevance. This relevance results in some sort of meaning or purpose, giving “shape” and meaning to data.

The transformation of data to information can be categorized five ways (Davenport & Prusak, 1998; Davenport, Harris, De Long & Jacobson, 2001).

1. Contexualized: reasons why the data was gathered.
2. Categorized: significance of the units of analysis or components of the data.
3. Calculated: data that has been analyzed mathematically or statistically.
4. Corrected: data with any errors removed.
5. Condensed: data summarized in a more concrete form.

Using these five techniques, data can gain relevance and meaning. Computers are often used to aid in this analysis, using their incredible processing power and data manipulation capabilities to search for hidden patterns or correlations. Even with the high-speed, data manipulation of a modern computer, human knowledge and insight are still the key

element in the interpretation and application of data (Davenport & Prusak, 1998). In some cases, it is a human expert who performs all the analysis. Of course, since human insight (and error) is involved, different information can be gleaned from the same data depending on the method of analysis and the person performing it. (Davenport, Harris, De Long & Jacobson, 2001).

Knowledge

It is with this third concept of knowledge where the popular opinions diverge. It is evident that the experts on knowledge have some differing opinions that have blurred the lines between knowledge and information (Kane, 2003). As a result, throughout this literature review, many different definitions and examples for knowledge were discovered. These definitions and opinions are detailed below.

Spiegler (2000) states that knowledge is information made actionable to an organization, mission specific expertise or experience. He also states that using knowledge is like playing "hide and seek", "…as we attempt to capture, record, or store knowledge - it turns back into information or data." Knowledge is more than just a record of facts, but a changing concept that carries different meanings depending on who is using it (Spiegler, 2000: 9).

Drucker (1993) refers to knowledge as information in action, and cites it as the key personal and economic resource. Knowledge is considered the most important resource to any organization. It is a very fluid commodity, and can only be gained through continuous improvement and the development of new, improved applications

using the wisdom and experience of an organization's skilled "knowledge" workers (Drucker, 1993).

Nonaka (1995: 21) calls knowledge "justified true belief", a dynamic process of defining and justifying personal belief in search of truth. He also uses the term "techne", described as information possessed in the mind; the wisdom and experience stored in the mind of a worker. It is often very difficult to stratify, but is still considered a valuable source of knowledge. A successful organization must be able to harness this "techne" in order to be truly successful and competitive in today's markets (Nonaka, 1995).

Tuomi (1999) takes a different tack by stating that knowledge comes first, which is then broken down into information and data. Using this point of view, the hierarchical chain of data, information, and knowledge is taken backwards. Knowledge must be broken down into information and data in order to be transferred to others, and that knowledge must first be acquired before any information or data can be gained (Tuomi, 1999).

Davenport and Prusak (1998: 5) state that knowledge is neither data nor information, but is related to both. They provide the most detailed (and lengthy) definition of knowledge, as stated below.

> Knowledge is a fluid mix of framed experience, values, contextual information, and expert insight that provides a framework for evaluating and incorporating new experiences and information. It originates and is applied in the minds of knowers. In organizations, it often becomes embedded not only in documents or repositories but also in organizational routines, processes, practices, and norms.

But with all these different points of view, all these definitions seem to share two common themes. First, that knowledge is information that can be used for immediate

insight or action (Spiegler, 2000). Second, that knowledge resides in a person's mind and represents the experience, concepts, values, or beliefs that established or define an individual's capability to take effective action (Alavi & Leidner, 1999).

Knowledge can also be defined at the organizational level as its ability to harness the experience and potential residing within an organization's workers to stimulate innovation and create new opportunities through competitive advantage (Davenport & Prusak, 1998). This organizational definition of knowledge can be further sub-divided into two separate parts: tacit and explicit (Hansen, 1999).

Tacit knowledge represents the internal experience and values of an individual. It is very personal in nature and is difficult to articulate and is very hard to transfer to others (Bloodgood & Salisbury, 1998; Nonaka, 1995). A good example of tacit knowledge is an auto mechanic, who can tell by the sound of a badly running engine where the malfunction might be and what would be the best course of action to quickly solve the problem. This ability to quickly "troubleshoot" this problem engine does not come from a book, but from years of experience working with and repairing engines. This type of knowledge and ability can only come from this experience and time, and can't be gained by just reading a book or studying written material (Bloodgood & Salisbury, 1998). It is important to note that tacit knowledge is of little use to an organization unless it can be converted into explicit knowledge, which can then be utilized by the organization (Probert, 2003).

The following example describes a successful application of tacit knowledge in a large Japanese company while developing a new product. This company wanted to develop a new product line of bread-making machines. After many failures, the project

designers realized they needed to some how harness the knowledge and experience of a master bread-maker in order to properly design and create a new bread-making machine. To gain this experience, they applied KM techniques in which an engineer on the design team performed a short apprenticeship with a master bread-maker. This trade of skills gave new insight to the design team, which resulted in an accelerated design process and the successful creation of a very profitable bread-making machine (Nonaka, 1995).

Explicit or "codified" knowledge is knowledge that can be easily transferred, stored, or written down (Spiegler, 2000). This is knowledge that is easy to stratify and record for future use (Hansen, 1999). Using a cookbook to create a simple meal is a good example of codified knowledge. Some would argue that explicit knowledge actually is knowledge that is simplified to the point of becoming mere information. Once knowledge "leaves" the human mind it loses some of its function and value and becomes a mere correlation of facts and data (Nonaka, 1995).

Knowledge Management (KM)

As with knowledge, there are many different definitions and concepts as to what is KM. The definition used in this research is not one expert's opinion, but a combination of many different ideas. Put simply, KM is a philosophy where an organization gains new insight, innovation or competitive advantage through the creation, analysis, and application of its data and information, including the experience (tacit) knowledge stored in the minds of its workers (Davenport & Prusak, 1998; Drucker, 1993; Nonaka, 1995). The advantage gained through KM is often in the form of faster process times, better product design, improved efficiency, lower cycle costs, etc. (North, 2003). Many

resources are used to implement KM, including knowledge repositories, knowledge maps, expert computer systems, organizational culture, and the experience and wisdom of an organization's workers (Davenport & Prusak, 1998; Davenport, Harris, De Long & Jacobson, 2001).

Out of the KM resources above, it is the tacit knowledge (experience and wisdom) contained within the minds of the workers where the most valuable knowledge resides (Alavi & Leidner, 1999). This is often the hardest knowledge to extract, since this type of knowledge and wisdom often defy written translation. Usually the only way to share this knowledge is through long term mentoring and apprenticeship (Davenport & Prusak, 1998). One of the goals of KM is to capture this tacit knowledge and make it available to the entire organization in a quick, efficient manner.

Implementing Knowledge Management (KM)

The implementation of KM is often a great challenge to organizations. Many leaders and managers in the business world mistake information for knowledge, and thus assume information management is KM (Davenport, De Long & Beers, 1998). This misunderstanding lies in the closely tied definitions of information and knowledge. Information is nothing more than a record of a process or event, an account of history or performance. Knowledge is information, but information that can be put into action (Drucker, 1993). It is not just a record of events, but a clue to future outcomes and challenges. Knowledge grants insight in to future possibilities, and this insight, when used properly, can result in new courses of action, new opportunities, and new innovations to be explored and exploited by an organization.

Unfortunately, this misunderstanding of knowledge and information leads many organizations to believe they are utilizing KM, when often they are not (Spiegler, 2000). To assist in dealing with these challenges, there are many different tools available to implement KM. Three of the most common tools, knowledge repositories, knowledge maps, and expert computer systems, are described in detail below.

Knowledge Repositories

Knowledge repositories are information systems used for storing data, information, and explicit knowledge (Davenport, De Long & Beers, 1998). They can be classified into three types: external knowledge (data/information gleaned from outside sources), structured internal knowledge (research reports, marketing material, organizational systems and processes), and informal internal knowledge (discussion databases, and lessons learned). These systems allow individuals within an organization access to large amounts of explicit (codified) knowledge in a structured, easily accessible format.

The most obvious example of a knowledge repository is the Internet (Davenport & Prusak, 1998). With its numerous search engines, ease of use, and global access, the Internet allows for a wealth of (possibly unreliable) data at one's fingertips. Within a corporation, a "lessons learned" database such as Army Knowledge Online (AKO), is another example of a knowledge repository (Bartczak, 2002). Using a web-based interface, AKO allows members to communicate with each other (via live chat and a "bulletin board" page), get real time news and information, and have access to a "lessons

learned" database with detailed records of past operational history and experiences (Army, 2004).

Knowledge Maps

Knowledge maps are best described as a company "Rolodex", an address book with detailed notes of each contact's relationship and importance to the organization. They usually consist of an organization structure chart and a phone list, which provide a directory of where the expertise is within that organization. A properly annotated knowledge map allows an employee with little or no experience to quickly find those workers with the expertise needed to answer any question (Davenport & Prusak, 1998). Knowledge maps facilitate the transfer of tacit knowledge within an organization through this rapid access to knowledgeable workers (Nonaka, 1995).

Many workers use knowledge maps everyday without even realizing it. From a custom list of contacts and phone numbers to an organizational chart, these self-made references are nothing more than personalized knowledge maps (Davenport & Prusak, 1998). One good example of a common knowledge map is a continuity folder. In many corporations, especially in the government, workers are encouraged (sometimes mandated) to build continuity folders stuffed with flow charts, reference documents, and other tidbits of valuable information pertaining to their daily job. When these workers move on to different positions, these continuity folders are left for their replacements, providing a valuable source of organizational and job related knowledge.

Expert Computer Systems

Expert computer systems provide KM support by using a dedicated computer system to replicate the knowledge of an expert worker (Davenport & Prusak, 1998). They are usually created for a very specific task or function and can provide valuable insight in a quick, efficient manner, but are not easily adaptable for new applications or situations (Nonaka, 1995).

As powerful as expert systems are, they are incapable of synthesizing new knowledge. They are limited by their programming, which dictates their procedures, routines, and the limits of its capabilities. Most expert systems use a “logic tree” style decision format to achieve a solution, making choices depending on situational variables. Thus, their solutions are limited by their prescribed programming, and they cannot determine a solution if a new condition or situation arises. Expert systems are valuable tools, but should be used with caution, and only in conjunction with an experienced worker, not in place of the worker (Davenport & Prusak, 1998).

Organizational Culture

Although not a KM tool per se, organizational culture can play a big role in the success of a KM system (Coakes, 2004). For KM to be effective, workers at all levels must be willing to share their information with a great level of trust. Whether its collaborating through a community of practice or mentoring a subordinate, workers must be willing to share their tacit knowledge in order to achieve significant results (Coakes, 2004; Brown & Duguid, 2002). This contradicts the ideology of most workers who were

“raised” to believe that knowledge should be hoarded in order to protect their job or worth to the organization (Drucker, 1993).

An organization’s leaders must take the forefront, and create policy to foster knowledge sharing through rewards, promotion, or recognition (Davenport & Prusak, 1998). It is with the proper organizational culture that the ideas of trust and sharing can be fostered and encouraged, resulting in the desired sharing of knowledge and experience (Brown & Duguid, 2002). Without this sharing, any organizational KM system will be doomed to failure (Hansen, 1999).

Knowledge Management in the Business World

Many organizations are starting to learn and understand the value of KM and what it means to their respective organizations (Brown & Duguid, 2002). Some organizations have taken the leap to utilize KM in their processes and have achieved great success. For most companies and businesses, success in this case means: increased innovation, improved customer service, higher profits, enhanced employee retention, and reduced costs through streamlined operations (Santosus & Surmacz, 2001). A few examples of some KM benefits are detailed below.

Examples of KM Benefits

The first example highlights a Los Angeles consulting office, which used a knowledge repository to store relevant information about past projects. This database was frequently searched for knowledge that could be used for current or future projects. Often, the solutions discovered were applicable, and resulted in reduced costs, quicker

designs, and improved accuracy for current projects. In addition, searches often produced data such as technical specifications, documents, and programs, which could be easily adapted to current projects, again saving time and money. In one case, this knowledge repository saved the consulting company over one full year of work, and resulted in the award of a big contract with a large corporation (Hansen, 1999).

Similarly, Davenport and Prusak (1995) cite a story about a large petroleum company that was looking for a way for their employees to collaborate on various projects while spread across the globe. Using KM concepts and theories, they developed a new teleconferencing system. This system allowed workers from different geographical locations to share ideas, and brainstorm together to solve problems. In one case, this system allowed an engineer to remotely solve a problem on a drilling platform, saving the company over $100,000 in costs by preventing expensive downtime and eliminating the need to dispatch engineers to the remote site (Davenport & Prusak, 1998).

This last example describes the successful application of KM in a large bakery products company. In an effort to improve their process, they created a knowledge repository (database) using data from one of its product divisions. Using this repository, they analyzed the product profitability for that division, looking for products that were not bringing in high sales revenue. This analysis (possible through the use of a knowledge repository) led to a 20% reduction of that division's product line, which in turn resulted in a 70% jump in profit in the first year this database system was used (Davenport, Harris, De Long & Jacobson, 2001).

Growing Dependence on Knowledge

As society continues to integrate computers and the Internet more and more into daily life, knowledge management becomes increasingly more important (Brown & Duguid, 2002). This exploding access to information and knowledge has created many changes in our economy and in the way we do business. These changes have accelerated the global economy, as evident by the tripling of global goods and services from 1980 to 2001 (Jimes & Lucardie, 2003). This in turn has created more demanding consumers as this acceleration in the market has increased competition and created more supply choices (Jimes & Lucardie, 2003). All of these effects have led to a new, buyer demand market where the buyers dictate what they want. This buyer-pull economy means that businesses must be ready to change their processes quickly in order to meet their customer needs (Nonaka, 1995). In addition, the efficiency and processing power of computers have drastically shortened the supply chain, making faster decisions even more important.

This has pushed many companies to streamline their process in order to get their items up for sale faster or at a lower price than their competitors (Zack, 1999). Of course, this increase in the pace of business has its associated costs, and is forcing companies to reduce costs and save money wherever possible. This is where KM comes in (Brown & Duguid, 2002). In order to compete, the businesses and companies of today must maximize the efficiency of their processes and systems in order to survive and thrive in today's markets. Companies no longer have the luxury of protracted research and product development cycles (Brown & Duguid, 2002). It is quickly becoming mandatory for modern organizations to be flexible and have the ability to deal with change. This is where KM can help the most, by utilizing the untapped wealth of knowledge and ability

available to an organization from its information systems and its worker's wisdom and experience. Knowledge gained from these sources can streamline processes, shorten process times, and reduce overall costs. With this ever-increasing pace of business, organizations must be able to change quickly to deal with these changing trends in order to remain competitive (Davenport & Prusak, 1998).

Knowledge Management in Education

As mentioned above, KM offers many benefits to a company, but these benefits are not just limited to commercial business. Educational organizations also have something to gain out of KM. These organizations play a critical role in our society, as they educate the workers that will make up the companies and organizations of tomorrow, and lead society into the future (Brown & Duguid, 2002; Piccoli, 1998). It is very important for educational organizations to constantly be looking for better ways to educate and train its students. Education is the fuel, which powers our society, and as such it is vital that the quality of education be sustained at a high level to ensure the success of all future organizations.

In the commercial world, education, training, and learning are key elements to any company or organization, no matter what their function or line of business. Whether it's training new workers, learning from past successes/failures, or educating its people about leadership techniques, these three elements are critical to any organization (Davenport & Prusak, 1998). As a result, it becomes important to further define education, training, and learning, the differences between them, and how they relate to each other.

Education, Training, and Learning

Education is a process where an individual is taught knowledge and skills, which enable them to deal with future problems and challenges (Drucker, 1993). Students are taught philosophy and theory about a topic in order to stimulate their growth of knowledge. The goal here is to expand their minds by giving them tools and techniques that can be used to solve problems (Drucker, 1993). As opposed to training, where workers are taught to do a specific task. Training is a process where a student is taught a step-by-step procedure as to how to accomplish something. The effort here is not to stimulate the growth of knowledge, but simply to impart a rote procedure for accomplishing a task (Patterson, 2003).

It is important to note, that education usually encompasses some sort of training in its process, but not vice versa. Think of training as learning a task, while education is learning for the future.

Learning differs from education and training above in that it deals with the ability of each student, as opposed to the method or objective of the instruction. Learning involves how well a student comprehends and retains new experiences, such as education or training. Learning is a measure of an individual's ability to process, utilize, and retain what is experienced or taught to them (Hwang, 2003). Obviously, a student's ability to learn is key to the effectiveness of their education or training, and must be factored into the entire teaching process. Organizations often overlook this aspect when trying to educate or train their workers (Hwang, 2003).

Where are we now

With the obvious importance of education to society, it's easy to assume that KM is embraced and used by education organizations. Unfortunately, that is not the case. Many educational organizations develop sophisticated e-learning or online classrooms and say they are applying KM to education, but that is not the case (Na Ubon, 2002). True KM involves innovation, the extraction of tacit knowledge, and the creation of new opportunities and ideas (Nonaka, 1995). Online classrooms and e-learning typically do not perform these functions (Na Ubon, 2002).

This is a perfect example of the "Shoemaker's Paradox", where everyone has a good pair of shoes except for the shoemaker's family. As mentioned in the first chapter, the shoemaker is so busy making everyone else's shoes that he neglects making shoes for his own family (Oliver, 2003). This similar situation is happening with KM and education. Academics are so busy touting the benefits of KM and its importance to the future that they are neglecting to apply it in their own realm of education (Oliver, 2003).

With knowledge and innovation comes change. As companies utilize KM to improve their systems and streamline their process, change will be an inevitable part of the equation. Workers will need to be retrained with new processes and procedures as innovations and improvements create change (Drucker, 1993). This same notion can be applied to the academic environment. Our educational systems are in place to train and prepare our work force to operate in the real world (non-educational) environment, and deal with future challenges (Drucker, 1993). As new knowledge is discovered and old paradigms are discarded, the educational environment must have the ability to adapt and

respond to these (inevitable) changes in order to properly educate our work force (Oliver, 2003).

In the DoD and the US Air Force (USAF) education and training are even more crucial to the success of their missions (DAF, 1993). The complexity of current weapon systems and the emergence of new technologies place even more demand on the expertise and decision-making abilities of each Airman (DAF, 2003). Air Force Basic Doctrine states that people are the decisive factor in war, and the development of our people are key to sustaining our force capability (DAF, 2003). Unfortunately, the only mention of KM concepts to improve education is the development on a virtual schoolhouse on the Air Force Knowledge Now (AFKN) website (Air Force, 2004; Bartczak, 2002; DAF 1993; DAF 1994).

Currently USAF training depends on the instructional systems development (ISD) model to design and implement new educational or training materials and systems (DAF 1993). The ISD system just does not have the capability to adjust quickly to changing educational trends and often results in the teaching of long outdated material (DAF 1993, DAF 1994). Without the use of KM in USAF educational and training systems, will continue to lag behind current trends and result in a loss of efficiency and expertise.

Just as in commercial business, educational and military training organizations need to constantly evolve or they risk being left behind. This not only lowers the value of education as a whole, but also creates collateral effects across the economy as more and more inexperienced, improperly prepared students enter the work force (Oliver, 2003). The effects for the military are much worse, as improper training can cause casualties and death.

Summary

As detailed in this chapter, knowledge is becoming the most important resource to any company or organization. KM is the key to unlocking the potential of knowledge and using it for innovation, profit, and competitive advantage. This chapter provided the history and background of knowledge and KM, detailing its impact and how it can benefit any organization, commercial or military. It also described the lack of KM application in education, and stressed the importance of its use. Chapter III will cover the methodology and tools used in this study of the key issued in the application of KM in education.

III. Methodology

Introduction

The purpose of this research is to determine the key issues concerning the application of knowledge management (KM) in education, by answering the following three investigative questions:

1. What does the literature identify as the key issues in the application of KM concepts in education?

2. Which of these KM issues appear to have the most relevance for application in education?

3. Which KM issues appear to have the least relevance for application in education?

This chapter describes the steps used to select the research methodology and how the methodology will answer these questions.

This research started with an initial literature review in effect to establish a framework for this study (Creswell, 1994). From this search, a distinct lack of consistency was discovered among the researchers and their associated articles concerning the key issues of implementing KM in education. There was no apparent agreement on the right course of action or even if any action should be taken at all. According to Swartz's research evolutionary model, the very foundation of any new research is the establishment of these most basic issues (Swartz, 2004). It is the establishment of theses key issues from which all other research in the field will base their efforts (Leedy, 2001). When there is no basic understanding of the key issues about a topic, the only option for research is to establish these vital foundations through a qualitative study (Creswell, 1994).

Deterministic	Stochastic	Unknown

Deterministic: Known at a causal level; explained variation or behavior; "complete covariance" description
Stochastic: Not known at a causal level; correlational description of behavior, unexplained variance; modeled as random process(es)
Unknown: Not described at a categorical level; uncertainty even at an observational level

Objective/Phase	Paradigm	Logic/Theory	Hypotheses	Data	Method	Causality
OBSERVATION "Facts"	Qualitative "Descriptive"	Inductive T Building	"Presence of A"	Field or Natural Setting	Pre-Experiments Ethnography Phenomenology Case Study	CONSTRUCT VALIDITY - Convergent - Divergent
CATEGORIZATION "Characteristics"			"Presence of A distinct from B"		Content Analysis Grounded Theory Historical	RATIONALITY - a priori - falsifiability
CORRELATION "Associations"	Quantitative "Prescriptive"	Deductive T Validating	"Covariance between amount of A and amount of B"	Lab or Designed Experiment	Observational Developmental Correlational Surveys	- parsimony CORRELATION - statistical sig - practical sig
CAUSALITY "Relationships"			"A causes B"		Designed Experiments - True - Quasi	TEMPORAL PRECEDENCE EXCLUSIVITY

Figure 3.1 Research Evolutionary Model (Swartz, 2004)

Qualitative Research

A qualitative research approach is appropriate when developing new insight or perspective about a phenomenon (Leedy, 2001). In the case of this research, the phenomenon is the application of knowledge management in education and the insights are the key issues concerning its use. This qualitative study will establish these key issues. The data for this research will come from existing articles, papers, and other documentation discussing the concepts of KM and education or training. Since the data for this research originates from written text, Denzin and Lincoln categorize it as a test as proxy for experience using free flowing text (Denzin & Lincoln, 2000). They list six methodologies that could be used for this type of data, but suggest content analysis as the most appropriate research method for this type of data (Denzin & Lincoln, 2000). Leedy

concurs with this description of content analysis as “a detailed and systematic examination of the contents of a particular body of material for the purpose of identifying patterns, themes, or biases” (Leedy, 2001, 155). By analyzing text, the researcher looks for “codes” or the intent of what is written (Leedy, 2001). Neuendorf (2002) also concurs by stating that a content analysis is a systematic, objective, quantitative, analysis of message characteristics. Each of these definitions show content analysis as an appropriate methodology for meeting the objectives of this research, to glean the message or “key issues” from an applicable set of literature. Thus, content analysis was chosen as the best methodology to answer the questions posed in this study.

Content Analysis

The content analysis methodology requires the researcher to identify the specific material to be analyzed and how to precisely code that material (Leedy, 2001). Then the researcher applies quantitative analysis techniques to a matrix of these coded entries to establish the central themes across the data (Denzin & Lincoln, 2000). According to Neuendorf, performing a content analysis is a nine-step process:

1. Theory and Rationale
2. Conceptualization
3. Operationalizations
4. Coding Schemes
5. Sampling
6. Training & Pilot Reliability
7. Coding

8. Final Reliability

9. Tabulation & Reporting

Each of these steps will be described on the following pages.

Theory & Rationale

This initial step answers two main questions, "what" content will be examined and "why" is it applicable for this study (Neuendorf, 2002). The focus of this content analysis involved generating the list of articles pertaining to the application of KM in education. The material chosen for review will be selected using various resources, as described in the "Sampling" section (on page 43). Since in all content analysis work the researcher is the largest source of bias, the goal will be to randomly pick articles based on their content, not source, to reduce any bias caused by researcher input in the article selection process (Leedy, 2001).

Conceptualization

This step describes what variables will be used in the research and how they will be conceptualized (Neuendorf, 2002). For the purposes of this study, knowledge management is defined in the second chapter, and is summarized here by two basic ideas. The first consists of the concepts or techniques that enable an organization to capture and structure its knowledge assets (Hwang, 2003). The second is an organization's ability to recognize and leverage the knowledge of its workers to provide a benefit to the organization through better decision making or as an asset for competitive advantage (Davenport & Prusak, 1998; Nonaka, 1996). Education is also defined in the second

chapter, but is summarized here as any reference to learning, teaching, education, or training. Both these definitions above (as detailed in the second chapter) form the basis of the material selected for study.

Operationalizations

This section defines the units of measure used in the research, a crucial step in the creation of a coding scheme (Neuendorf, 2002). The only unit of measure used for this research was each individual article or paper used in this study. No weight or bias was given based on the author or source of the material to reduce researcher input into the selection process. The fewer choices and inputs made by the researchers, the less chance for researcher bias to affect the results.

Coding Schemes

The coding scheme is the manner in which the data is analyzed and categorized. A search for previous examples of schemes used for similar coding was performed. However, no reference could be found that was applicable for this field of study, and no other research of this type had been performed. Thus, an *a Priori* coding scheme was created based on a five point Likert scale (Neuendorf, 2002; Stemler, 2001), as shown below:

0 Not Mentioned – the issue is not mentioned at all in the material

1 Mentioned – the issue is merely mentioned in the material

2 Defined – the issue is defined in the material

3 Explained – the issue is developed to a small degree; a sub-point

4 Key Idea – the idea is fully developed and is the focus of the paper

The primary researcher performed an initial analysis of each of the articles selected for this study, searching for the key issues and codifying the results (the exploratory aspect of this analysis). The scale mentioned above was used in the codification of the selected articles, ranking the discovered issues from "0" to "4". After completing the analysis of all the material, the results were compiled, sorted to create a list of preliminary key issues, and then ranked for initial relevance from highest to lowest.

It was arbitrarily decided by the primary researcher that only one issue for each article could be coded a "4". This step varies from normal coding procedure by introducing a small amount of dependence in the coding results (Leedy, 2001). This dependence is due to the established coding scheme above, where an issue coded "4" is determined to be the single main focus of the paper/article. This limitation in coding was instituted to prevent the inflation of coder values during the article evaluations. This fact will be taken into account in the Chapter IV, when establishing intercoder reliability.

The list of key issues generated through this analysis was sorted and used to create a codebook, which was used by the research coders in their analysis of the material. The coders were tasked to analyze and assess the existence of these issues contained in the codebook, using the given list and the same coding scheme described above.

Sampling

Since a complete census of the population is not possible, a random selection process was used to gather the content of the research (Neuendorf, 2002). The articles

used in this study were gathered utilizing various online database search engines (ProQuest, DTIC, First Search, and EBSCO). Each of these search tools grant access to thousands of current periodicals, newspapers, peer-reviewed journals, thesis papers, and dissertations, covering commercial, academic, and government publications. In addition, two Internet-based searched engines (Google and Yahoo) were used to check for other sources not listed in the four databases above and to ensure the maximum amount of search coverage possible.

Articles were selected solely on the basis of their abstracts and whether they contained the search parameters listed below. The first search was performed using the exact phrase, “knowledge management in education”, but resulted in only four sources. Since at least 30 sources were required to obtain a suitable sample size, this search criterion was revised. Multiple searches were conducted using different combinations of syntax and phrasing, but each led to an inadequate number of replies.

After reviewing the results of these multiple searches, it was discovered that the exact phrasing of the parameters and the word “education” were the limiting factors in obtaining replies. As a result, exact phrasing was dropped from the search criteria, and different variations and synonyms of “education” were explored for their proximity in meaning and applicability to the research. This search resulted in the following revised search parameters (used without exact phrasing): education, training, learning, and knowledge management. These revised searches resulted in 35 articles suitable for use in this study, classified by nine separate categories:

1. Education & Training (3)
2. Knowledge Management (3)

3. Knowledge Creation (4)

4. Knowledge Transfer & Storage (4)

5. Knowledge Management in Education (9)

6. Knowledge Management & Learning (2)

7. Web/E-Learning & Knowledge Management (3)

8. Web/E-Learning & Training (3)

9. University Organization (3)

A complete listing of the articles used is referenced in Appendix A: “Articles Used in this Research.”

Training and Pilot Reliability

This section describes how the research coders were trained to perform their analysis. In this study, a total of four independent coders, in addition to the primary researcher, were used to analyze the articles. The four-person coding panel consisted of a female captain and three male first lieutenants, each with over 10 years of military service. All coders were volunteers from AFIT and were all pursuing a Master’s degree in Information Resource Management, with the same or similar background as the primary researcher. Each of the four coders has been exposed to KM, and has taken the same courses discussing KM ideas and concepts.

As recommended by Neuendorf, before the analysis was performed, all coders participated in a one-hour training session, where they were briefed about the objectives of the work and the methodology to be employed (Neuendorf, 2002). Each coder was given a sample article (one not used in the study) to be reviewed and coded, and was

given 72 hours to complete their analysis and coding. This technique was used to ensure all coders have the same understanding of the analysis and coding procedure and to improve the intercoder reliability (Neuendorf, 2002). The analysis of the sample article indicated similar results, validating the training process and ensuring that all coders were prepared to perform their analysis of the study material.

Coding

The primary researcher independently coded all of the study articles, recording the results in a Microsoft Excel spreadsheet. Each of the coders was given 10 articles, a codebook (see Appendix B: "Sample Codebook"), and a copy of the Microsoft Excel spreadsheet to store their analysis results. In order to assess reliability, a fourteen percent overlap (5 articles) was used in the distribution of the articles amongst the coders (Neuendorf, 2002). The duplicated articles were not known to any of the coders, and each coder was not allowed to share their articles with other coders or discuss their assigned articles with anyone else (including the primary researcher). Each coder's data must be their own evaluation, without any outside influence. This isolation amongst coders will be crucial to prevent corruption of the data through group discussion and collaboration.

Intercoder reliability will be evaluated using percent agreement and Cohen's Kappa statistical methods for the overlapping articles. Both methods are commonly used in content analysis, and are well suited for assessing coder agreement (Neuendorf, 2002). The percent agreement function will be a simple comparison of the differences in the ratings of the two coders, and will result in a percent level of agreement between the two

(Neuendorf, 2002). Cohen's Kappa will improve this result by reducing chance agreement from this percent, resulting in a more accurate estimation of coder agreement (Cohen, 1960). Both scores will provide an assessment of intercoder reliability, and will be used to validate the coding scheme and applicability of the data.

Final Reliability

One final measure of reliability will be used to validate the results. This reliability will be measured using a percent agreement algorithm, comparing the primary researcher's ratings and the applicable coder's ratings for each of the key issues across all 35 articles. This algorithm will result in a percentage score for each article indicating the amount of agreement between the primary researcher and the applicable coder(s) for that article. Higher percent scores indicate a high level of agreement, while lower scores indicate less agreement. This method of validity was selected because it is the choice most widely used in content analysis due to its applicability and ease of use (Neuendorf, 2002; Perreault, 1989).

Tabulation and Reporting

This final step is where the results of the study are tabulated and reported (Neuendorf, 2002). For this research, the final results will be recorded and complied in a Microsoft Excel spreadsheet. Once complete, the results from each of the four coders will be combined on the same Microsoft Excel spreadsheet.

Each article will be sorted into three separate columns. The first column will contain the primary researcher data, and the second column the combined coder data.

This arrangement will allow for a quick comparison of the key issues noted and any disagreement amongst the researchers. Any difference noted here will be listed in the third column, acting as a check for validity and to assist in answering the third research question. Then, each set of article data (in three columns) will be sorted, combining the primary researcher data and the combined coder data, and ranking them in descending order. This arrangement will establish the most relevant issues for the first research question and ranking them to answer the second and third questions. This spreadsheet data will be graphically displayed on charts to represent the data and to identify patterns and trends. These findings will be discussed in Chapter IV.

Methodology Limitations

Any methodology is not without its limitations or confounds. In this case, there were some limiting factors that have affected the results of this work and should be noted. First, as with all qualitative research, the researchers are key instruments in this type of study (Leedy, 2001). As a result, researcher bias can drastically affect the research results in many ways, stemming from issues such as: researcher background, previous knowledge, personal predispositions, researcher skill, and competency (Leedy, 2001). Since the primary researcher and coders are key to this study, there is no method to completely remove all possible bias. To minimize this effect, all researchers in the study were briefed of these concerns and were tasked to take these elements into consideration while performing their analysis. In addition, the sample articles used in this content analysis was selected using a random process with no researcher input. Again, the goal

was to reduce researcher bias by reducing or eliminating researcher choice in the selection process.

Second, there is no way of completely capturing every known piece of written material concerning the application of KM in education. Thus, a sample from this population was used for this research. The efforts described previously in this chapter detail the techniques used to obtain a representative sample. There is no way to ascertain for certain whether or not this sample incorporates all the key issues or is representative of the population. This issue must be taken into account when drawing conclusions from these results (Leedy, 2001).

Summary

Considering the type of data and the research questions to be answered, an exploratory content analysis was deemed the most appropriate research method. This conclusion is confirmed by authors: Denzin and Lincoln, Leedy, and Neuendorf (Denzin & Lincoln, 2000; Leedy, 2001; Neuendorf, 2002). Neuendorf (2002) provides the greatest assistance by illustrating a framework for this research. This framework provides a step-by-step procedure for carrying out this content analysis. Her approach also helped to reduce researcher bias and increase the validity of the results by reducing researcher input in the data selection and by providing a set of standards and guidelines to follow.

In a content analysis, the researcher is considered an instrument used to gather data. Thus, the results of these studies are subject to the skill, ability, and biases of each researcher. To counteract this inherent bias, each researcher should strive to separate

themselves as much as possible from subjective evaluations of the data or the methodology in an effort to minimize this effect of researcher bias (Leedy, 2001). This effort to reduce bias is echoed by both Neuendorf (2002) and Denzin and Lincoln (2001).

IV. Results & Analysis

Introduction

This chapter describes the key issues and concepts discovered during the content analysis of the selected articles relating to KM and education. The results of this analysis are presented in the following chapter.

As stated in the first chapter, the goal of this study was to answer three research questions using an exploratory content analysis methodology:

1. What does the literature identify as the key issues in the application of KM concepts education?

2. Which of these KM issues appear to have the most relevance for application in education?

3. Which KM issues appear to have the least relevance for application in education?

The purpose behind these questions is to define what issues are important and/or the most pertinent when applying KM to education. It is expected that once these answers are established, more research will be performed using the data gained from this study to create a working KM model, which can then be applied in a practical education setting.

The following sections discuss the procedures used, the type of data gathered, and how the results address the research questions presented above. The first section deals with the primary researcher results, describing the data collection techniques and analysis of the results. The second section presents the coders data collection and the analysis of their results. Finally, the third section provides a complete view by combining the primary researcher results with the coder results, and answering the three research questions put forth in this study.

Throughout this research, content validity was checked using a percent agreement algorithm between the primary researcher and each coder for all applicable articles. Each section describes the use of this algorithm and uses pie charts and bar graphs as visual aids to display and analyze the data collected at each stage of this study.

Primary Researcher Data

The data set for this research was composed of 35 articles, papers, and journals all matching the search criteria, as described in the third chapter. Due to the lack of material directly addressing the topic of KM and education, a very loose search criterion was used in order to generate a minimum suitable sample size of at least 30 items for review (Leedy, 2001). As a result of these criteria, many articles in the data set were not directly applicable to the topic of study, but were used nevertheless to prevent researcher bias by eliminating researcher input in the selection of the analysis material.

The primary researcher performed a thorough analysis of this 35-article data set, analyzing each article for any issues that addressed KM, learning, training, or education. Each key issue identified was rated by its level of importance in each article using a 5-point Likert scale as described in the third chapter.

0 Not Mentioned – the issue is not mentioned at all in the material

1 Mentioned – the issue is merely mentioned in the material

2 Defined – the issue is defined in the material

3 Explained – the issue is developed to a small degree; a sub-point

4 Key Idea – the idea is fully developed and is the focus of the paper

This analysis resulted in a list of 48 preliminary key issues for the application of KM in education. All of these assigned ratings for each key issue were tabulated and summed across all 35 articles of the data set, creating a cumulative issue rating (IR) for each key issue. This resulted in the following chart of key issues as coded by the primary researcher using this IR.

Issue Rank	*Preliminary Key Issue*	*Issue Rating*	*Issue Rank*	*Preliminary Key Issue*	*Issue Rating*
1	Knowledge Management & Exploitation	63	*25*	Reflection (Feedback)	14
2	Technology & Infrastructure (IT)	62	*26*	Knowledge Community (COP)	13
3	Collaboration (Sharing)	61	*27*	Learn by Doing (Simulation)	12
4	Knowledge Transfer & Diffusion	59	*28*	Data & Information Standardization	12
5	Knowledge Creation (Capture)	45	*29*	Knowledge Conversion (Spiral)	10
6	Organizational Environment (Culture)	43	*30*	Knowledge Requirements (Gap Analysis)	9
7	Systems Thinking (Processes)	40	*31*	Affecting Behavior Change	9
8	e-Learning	39	*32*	Process Integration	8
9	Knowledge Mapping (Identification)	31	*33*	Learn by New Ideas (Generative)	8
10	Knowledge as a Resource	31	*34*	Storytelling	7
11	Explicit vs. Tacit Knowledge	31	*35*	Mentoring (for Training)	7
12	Knowledge Storage (Memory)	30	*36*	Incentive Based Motivation	7
13	Interactivity	27	*37*	Assessing Learning	7
14	Organizational Learning	26	*38*	Student Retention	6
15	Trust (in Sharing)	24	*39*	Group (Cooperative) Learning	6
16	Individual Learning Ability	22	*40*	Adapted Learning (Improving Efficiency)	6
17	Student Centered (Personalization)	19	*41*	Training & Teaching Time	5
18	Management Support (Leadership)	19	*42*	Establish Goals & Priorities	5
19	Continuous Improvement & Learning	19	*43*	Using Lessons Learned	4
20	KM Strategy	18	*44*	Just in Time Training	4
21	Traditional Structured Learning	17	*45*	Visual Learning	3
22	Organizational Structure	17	*46*	Learn by Problem Solving	3
23	Knowledge Measurement	17	*47*	Distributed Learning	3
24	Core Competence Building	15	*48*	Education vs. Training	2
				Total Cumulative IR (by Primary Researcher)	***945***

Figure 4.1 Primary Researcher Key Issues (ranked by IR)

As shown by Figure 4.2 (on page 53), the first 12 key issues (the top 25%) appeared to be the most significant by constituting just over 56% (535) of the Total Cumulative IR for the primary researcher (945). In addition, the first 4 key issues (the top 8%) showed major significance by consisting of 26% (245) of the Total Cumulative

IR. Since these first 12 issues seem to carry the most weight, their results are compared separately from the rest on a pie chart (by IR) in Figures 4.3 and 4.4 (on page 54).

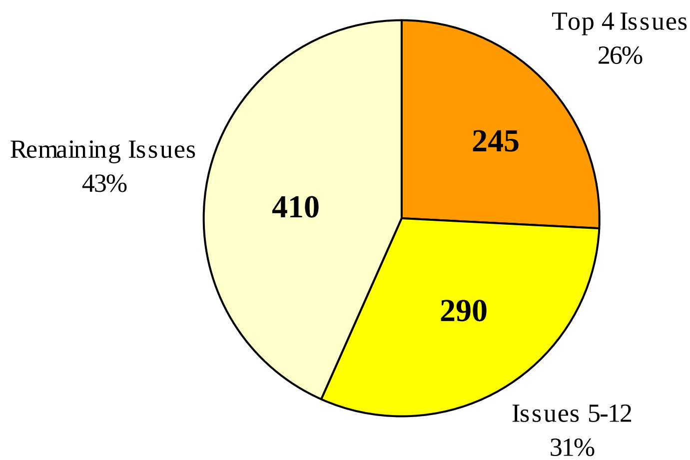

Figure 4.2 Total Key Issue Rating Distribution (Primary Researcher)

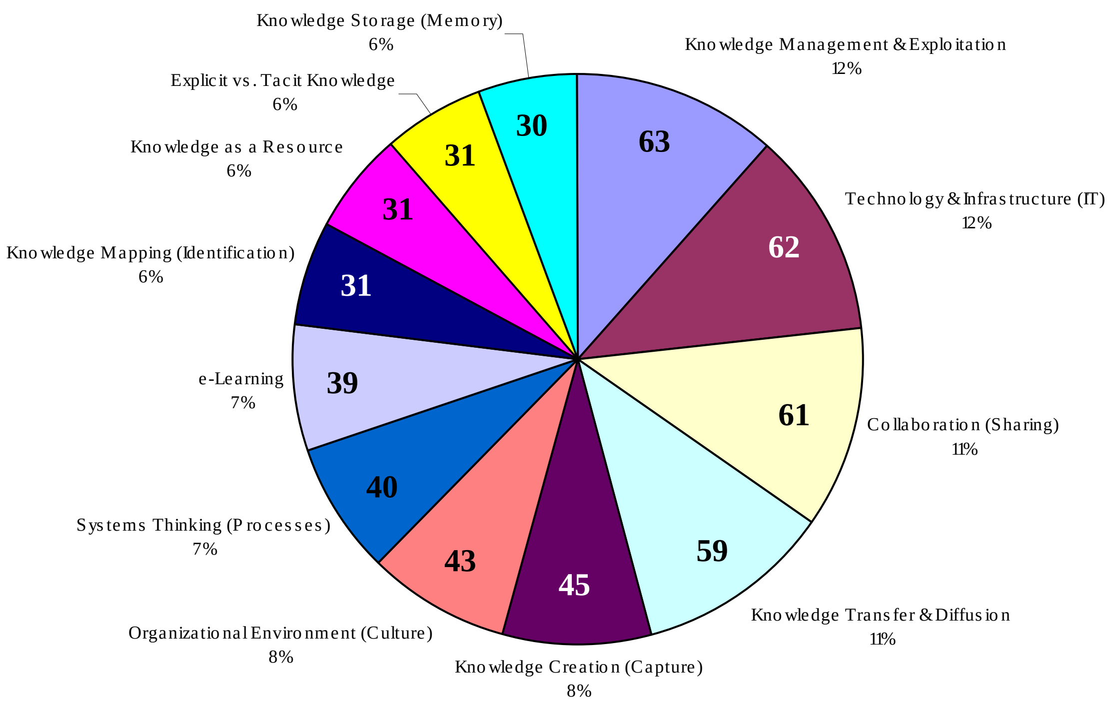

Figure 4.3 Top 12 Issue Rating Distribution (Primary Researcher)

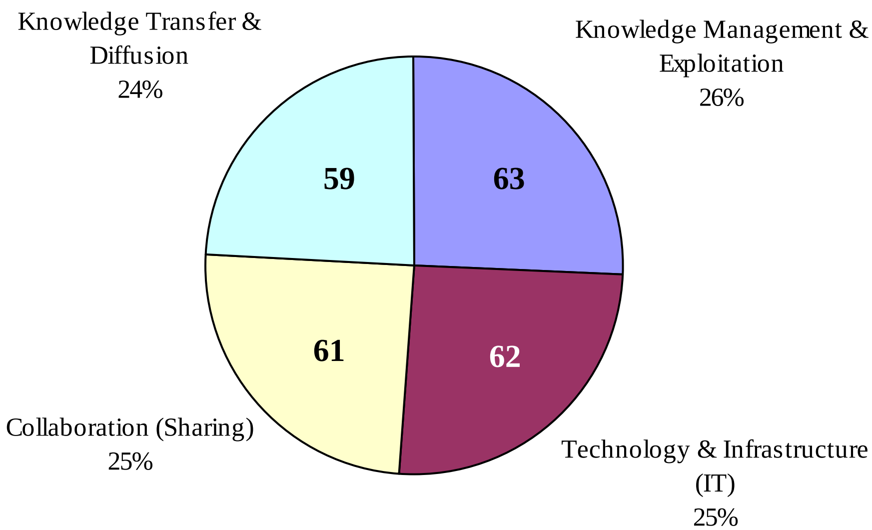

Figure 4.4 Top 4 Key Issue Ratings Distribution (Primary Researcher)

As can be seen from the previous charts, the first 12 key issues seem to be the most pertinent out of the 48 total key issues discovered. Out of those 12, the first 4 appear to have the most significance with just over one quarter of the Total Cumulative IR. Among theses 4 issues, all seem to have the same relative impact with an almost identical distribution for all 4 (see Figure 4.4 above).

In addition to the IR for each key issue, each article in the data set was rated for its relevance to the research topic by summing all the ratings for the key issues assigned to that article. From this article relevance ranking (ARR), the articles were placed in order from highest to lowest rank (the most applicable to the least applicable). This ARR was used for determining coder-reading assignments, with the five highest ranked articles assigned to two separate coders. By ranking the articles in this fashion, the most relevant articles (with the highest ARR) were subjected to a more in depth analysis by multiple coders in the hopes of obtaining more substantial data from these articles.

Co-researcher (Coder) Data

In order to provide some rigor and validity to the primary researcher's results, four co-researchers (coders) were used to reevaluate the 35-articles in the data set and the issues contained within (Neuendorf, 2002). These coder results were used to test and verify the results of the primary researcher and to establish a level of reliability for the final results.

After completion of the primary analysis, a codebook was generated listing each of the 48 key issues discovered by the primary researcher during his review. Each of the four coders was given a copy of this codebook (a Microsoft Excel spreadsheet) and their 10 assigned articles (see Appendix B "Sample Codebook"). Coders were given one month to finish their analysis of their assigned articles, with all their analysis to be recorded in their applicable codebook. They were not allowed to share codebooks or compare information with anyone (including each other or the primary researcher) until all of their analysis was complete.

Five articles (14% of the 35 total) were selected for review by two different coders. This duplication had two main goals, to establish intercoder reliability, and as an extra validity check since these articles were considered the most closely related to the topic of study and were expected to yield the most pertinent information. The five articles with the highest ARR were selected for this review. These duplicated articles brought the total number of articles assigned from 35 to 40 (10 assigned to each coder). The breakdown of article assignments for each coder is illustrated in Figure 4.5 (on page 56), with the duplicated articles highlighted.

Coder #	Articles Assigned									
1	**34**	**28**	30	25	24	7	1	20	27	11
2	**35**	**3**	26	32	9	8	16	13	15	21
3	**34**	2	10	**28**	**29**	31	17	19	14	33
4	**35**	**3**	**29**	22	23	6	12	18	4	5

Figure 4.5 Coder Article Assignments

The combined analysis for all four coders resulted in a second list of 48 coder-selected key issues for the application of KM in education. As with the primary researcher data in Figure 4.1 (on page 52), all the ratings for each key issue were tabulated and summed across all 35 articles of the data set, creating a cumulative IR for each key issue. The chart below represents this analysis using this cumulative IR.

Issue Rank	Preliminary Key Issue	Issue Rating	Issue Rank	Preliminary Key Issue	Issue Rating
1	Knowledge Management & Exploitation	76	25	Trust (in Sharing)	15
2	Technology & Infrastructure (IT)	74	26	Management Support (Leadership)	14
3	Collaboration (Sharing)	57	27	Student Centered (Personalization)	14
4	Knowledge Transfer & Diffusion	56	28	Affecting Behavior Change	13
5	Organizational Environment (Culture)	50	29	Assessing Learning	13
6	Organizational Learning	39	30	Knowledge Measurement	13
7	e-Learning	36	31	Process Integration	13
8	Knowledge Creation (Capture)	36	32	Knowledge Mapping (Identification)	12
9	Explicit vs. Tacit Knowledge	32	33	Establish Goals & Priorities	11
10	Continuous Improvement & Learning	29	34	Mentoring (for Training)	11
11	Knowledge as a Resource	28	35	Reflection (Feedback)	11
12	Knowledge Community (COP)	23	36	Learn by Doing (Simulation)	9
13	Individual Learning Ability	21	37	Storytelling	9
14	KM Strategy	19	38	Interactivity	8
15	Systems Thinking (Processes)	19	39	Learn by Problem Solving	8
16	Knowledge Storage (Memory)	18	40	Training & Teaching Time	7
17	Organizational Structure	18	41	Using Lessons Learned	7
18	Group (Cooperative) Learning	17	42	Visual Learning	7
19	Knowledge Conversion (Spiral)	17	43	Data & Information Standardization	5
20	Adapted Learning (Improving Efficiency)	16	44	Just in Time Training	5
21	Distributed Learning	16	45	Core Competence Building	4
22	Incentive Based Motivation	16	46	Education vs. Training	4
23	Traditional Structured Learning	16	47	Learn by New Ideas (Generative)	3
24	Knowledge Requirements (Gap Analysis)	15	48	Student Retention	2
				Total Cumulative IR (by Combined Coders)	*962*

Figure 4.6 Combined Coder Key Issues (ranked by IR)

Again it was noted by Figure 4.7, that first 12 key issues (top 25%) appeared to be the most significant by constituting just over 55% (536) of the Total Cumulative IR for the combined coders (962). In addition, the first 4 key issues (the top 8%) showed major significance by consisting of 26% (245) of the Total Cumulative IR. Since these first 12 issues seem to carry the most weight, their results are compared separately from the rest on two pie charts (by IR) in Figures 4.8 and 4.9 (on page 58).

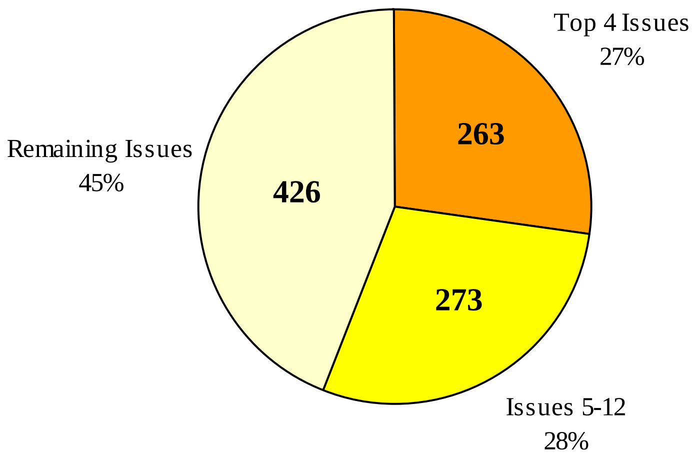

Figure 4.7 Total Key Issue Rating Distribution (Combined Coders)

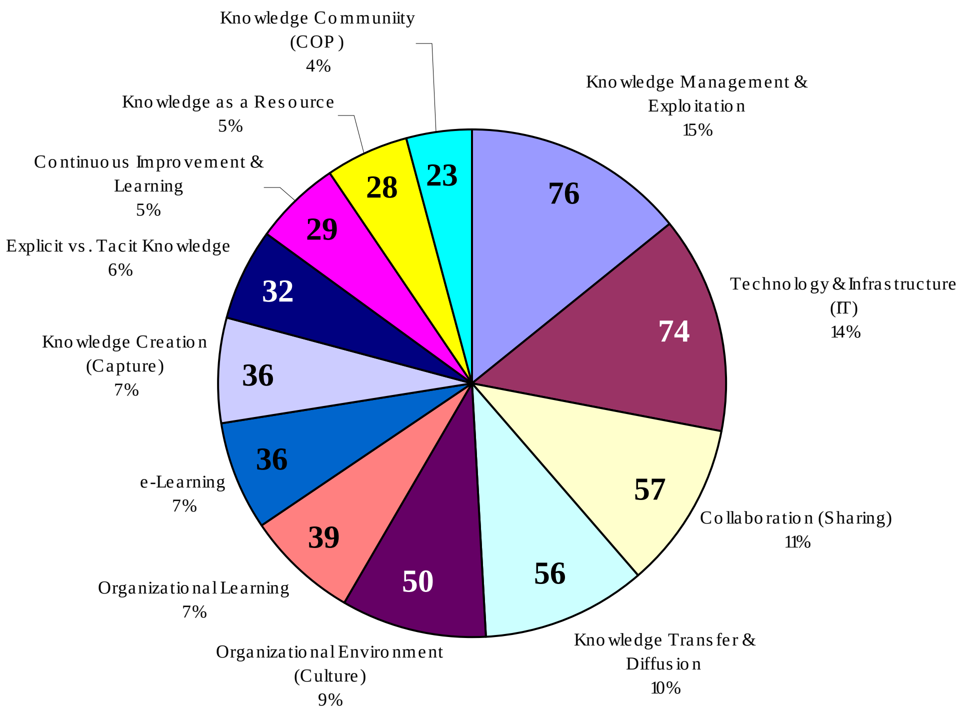

Figure 4.8 Top 12 Issue Rating Distribution (Combined Coders)

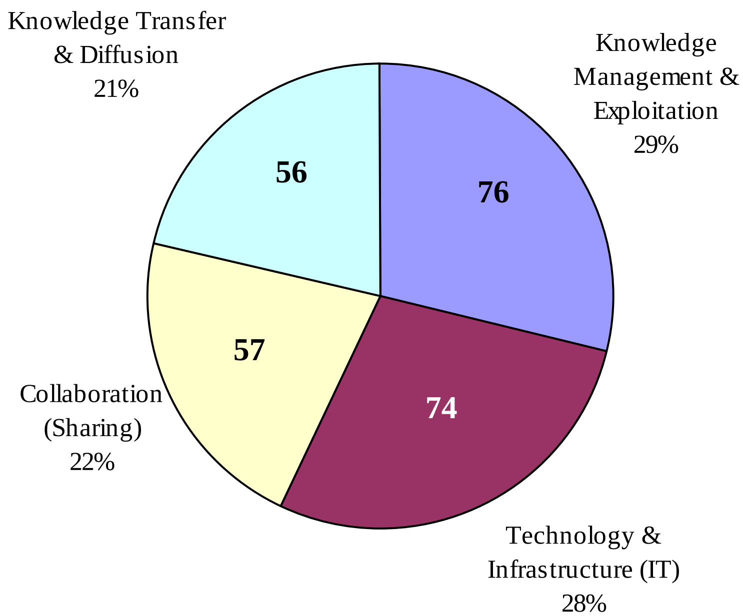

Figure 4.9 Top 4 Key Issue Ratings Distribution (Combined Coders)

As with the primary researcher results (see Figure 4.1 on page 52), Figure 4.8 (above) illustrates the combined results of the four coders for the first 12 key issues that

appear to have the most impact on the application of KM to education. This percentage (56%) is exactly the same as the primary researcher in Figure 4.3 (56%), indicating the distributions of both sets of ratings are very similar.

This combined coder analysis is taken one step further by looking at the first four key issues to determine their relevance, just as the primary researcher (see Figure 4.4 on page 54). These first 4 combined coder key issues consisted of 27% of the Total Cumulative IR for the combined coder results, almost exactly the same as the primary researcher total of 26% (see Figure 4.2 on page 53).

These similarities above can be readily seen in Figure 4.10 by directly comparing the primary researcher and the combined coder results (Figures 4.1 and 4.6) for the first twelve key issues.

Issue Rank	*Primary Researcher Key Issues*	*Issue Rating*
1	Knowledge Management & Exploitation	63
2	Technology & Infrastructure (IT)	62
3	Collaboration (Sharing)	61
4	Knowledge Transfer & Diffusion	59
5	Knowledge Creation (Capture)	45
6	Organizational Environment (Culture)	43
7	Systems Thinking (Processes)	40
8	e-Learning	39
9	Knowledge Mapping (Identification)	31
10	Knowledge as a Resource	31
11	Explicit vs. Tacit Knowledge	31
12	Knowledge Storage (Memory)	30

Issue Rank	*Combined Coders Key Issues*	*Issue Rating*
1	Knowledge Management & Exploitation	76
2	Technology & Infrastructure (IT)	74
3	Collaboration (Sharing)	57
4	Knowledge Transfer & Diffusion	56
5	Organizational Environment (Culture)	50
6	Organizational Learning	39
7	e-Learning	36
8	Knowledge Creation (Capture)	36
9	Explicit vs. Tacit Knowledge	32
10	Continuous Improvement & Learning	29
11	Knowledge as a Resource	28
12	Knowledge Community (COP)	23

Figure 4.10 Top 12 Key Issue Ratings Comparison (Primary Researcher & Combined Coders)

As can be seen from Figure 4.10 above, the first 4 key issues (dark highlighted) for both the primary researcher and the combined coder ratings match perfectly (with slight differences in their IRs). In addition, five other key issues (light highlighted) are mentioned in both coded results, but are ranked differently. From the comparison above

it’s clear that there is a high amount of agreement between the primary researcher and the combined coder ratings for what appear to be the 12 significant key issues in the application of KM to education.

To establish consistency and a measure of validity amongst coders, intercoder reliability was calculated using a percentage agreement between coders for the duplicated articles, and applying the Cohen’s Kappa statistic to the results. As noted previously, the top five ARR ranked articles (14%) were selected from the data set of 35 articles. Each of these selected articles was assigned to two different coders.

First, a percent agreement was calculated for each of the five repeated articles by summing the absolute value of the difference between the coder’s results and dividing it by the total number of key issues (Neuendorf, 2002). Two scores are obtained from this algorithm, a raw percent agreement score indicating the percentage of a total matches (no difference in coder ratings), and an adjusted percent agreement score indicating the percentage of matches within one point. This adjusted score was established by the primary researcher due to the intent of the coding scheme used in this analysis.

A Likert scale was used in the coding scheme to both establish the existence of a key issue, and to identify it strength of emphasis, or level of intensity, in the applicable article. Thus, if the coder’s scores vary by only one point, then they are essentially saying the same thing with only a slight variance in the level of intensity. The adjusted percent agreement score is used to adjust for this slight variance in intensity, and allows for more clarification and detail in the results.

Second, a quadratic weighted Cohen’s Kappa statistic was used to reduce the element of chance agreement between coders. A quadratic weighted statistic was used

because the data was ordinal in nature (Jansen, 2004). Also, the coding scheme tended to create data that was quadratic in nature due to the limitation of one “4” rating per article (see Chapter III), and the high number of “0” ratings due to its use as a default (does not exist) value in the coding (Lowry, 2004). The results of these calculations are noted on Figure 4.11 below.

Article Number	***35***		***34***		***3***		***28***		***29***		***Average***
Reviewer #	2	4	1	3	2	4	1	3	3	4	***Scores***
% Agreement (Raw)	***0.65***		***0.48***		***0.52***		***0.65***		***0.71***		***0.60***
% Agreement (Adjusted)	***0.90***		***0.79***		***0.69***		***0.92***		***0.90***		***0.84***
Cohen's Kappa	***0.71***		***0.39***		***0.46***		***0.72***		***0.59***		***0.57***

Figure 4.11 Intercoder Reliability Scores

The average raw percent agreement between coders was 60%, while adjusted percent agreement was 84%. This indicates that when two coders analyzed the same article, they coded the key issues the same 60% of the time, and varied their ratings by only one point 84% of the time. Neuendorf (2002) states that what is considered significant agreement varies a lot depending on the type of research performed. Any agreement standard is usually based off of the results of prior research (Neuendorf, 2002). Since there is no prior research of this kind, there is no reference from which to compare these results. Thus, there is no benchmark value for acceptance, but considering the large number of possible key issue (48)/article (35) combinations, these scores show an acceptable level of agreement.

The average Cohen’s Kappa statistic between coders was 0.57, which according to Neuendorf is considered an inadequate level of agreement because a Kappa score must be > 0.70 to be considered satisfactory (Neuendorf, 2002). But there is a problem with

Kappa when it is used with skewed data (as is the case with this research), where the data is not evenly distributed across all possible case values (Stemler, 2004; Landis & Koch, 1977). In this circumstance, Kappa produces severely understated scores resulting in inaccurate assessments of agreement (Landis & Koch, 1977). In this case, Landis and Koch recommend using the following strength of agreement chart to properly evaluate this Kappa statistic (1977).

Kappa Statistic	*Strength of Agreement*
< 0.00	Poor
0.00-0.20	Slight
0.21-0.40	Fair
0.41-0.60	Moderate
0.61-0.80	Substantial
0.81-1.00	Almost Perfect

Figure 4.12 Cohen's Kappa Strength of Agreement (Stemler, 2004; Landis & Koch, 1977)

An average Cohen's Kappa statistic of 0.57, as indicated on Figure 4.12 above, indicates a moderate strength of agreement (Stemler, 2004; Landis & Koch, 1977). Based off the intercoder reliability scores from Figure 4.11 (on page 61) and Figure 4.12 above, both Cohen's Kappa and the raw/adjusted percent agreement indicate an adequate level agreement exists amongst the coders, validating the coding scheme and the subsequent coding results.

Combined Primary Researcher and Coder Data

The combined analysis of the primary researcher and all four coders resulted in a third list of the 48 key issues for the application of KM in education. As with the primary researcher data in Figure 4.1 (see page 52) and the combined coder data in Figure 4.6 (see

page 56), all of these assigned ratings for each key issue was tabulated and summed across all 35 articles of the data set, creating a cumulative IR for each key issue. This calculation resulted in the following chart of key issues representing the combined coded analysis of the primary researcher and all four coders using this cumulative IR.

Issue Rank	*Preliminary Key Issue*	*Issue Rating*	*Issue Rank*	*Preliminary Key Issue*	*Issue Rating*
1	Knowledge Management & Exploitation	154	*25*	Knowledge Conversion (Spiral)	30
2	Technology & Infrastructure (IT)	143	*26*	Reflection (Feedback)	29
3	Collaboration (Sharing)	125	*27*	Incentive Based Motivation	26
4	Knowledge Transfer & Diffusion	124	*28*	Process Integration	25
5	Organizational Environment (Culture)	100	*29*	Knowledge Requirement (Gap Analysis)	24
6	Knowledge Creation (Capture)	84	*30*	Group (Cooperative) Learning	24
7	e-Learning	76	*31*	Affecting Behavior Change	24
8	Organizational Learning	70	*32*	Learn by Doing (Simulation)	23
9	Explicit vs. Tacit Knowledge	66	*33*	Adapted Learning (Improving Efficiency)	23
10	Systems Thinking (Processes)	64	*34*	Core Competence Building	22
11	Knowledge as a Resource	63	*35*	Mentoring (for Training)	20
12	Knowledge Storage (Memory)	50	*36*	Distributed Learning	20
13	Continuous Improvement & Learning	48	*37*	Assessing Learning	20
14	Knowledge Mapping (Identification)	45	*38*	Establish Goals & Priorities	17
15	Individual Learning Ability	45	*39*	Data & Information Standardization	17
16	Trust (in Sharing)	42	*40*	Storytelling	16
17	KM Strategy	41	*41*	Using Lessons Learned	13
18	Knowledge Community (COP)	40	*42*	Training & Teaching Time	13
19	Management Support (Leadership)	39	*43*	Learn by Problem Solving	11
20	Traditional Structured Learning	38	*44*	Learn by New Ideas (Generative)	11
21	Interactivity	37	*45*	Visual Learning	10
22	Organizational Structure	36	*46*	Student Retention	9
23	Student Centered (Personalization)	35	*47*	Just in Time Training	9
24	Knowledge Measurement	30	*48*	Education vs. Training	6
				Total Cumulative IR (Primary & Coders)	***2037***

Figure 4.13 Combined Primary Researcher-Combined Coder Key Issues (ranked by IR)

Reliability and validity of this data was tested using percent agreement and the raw/adjusted algorithms, as discussed with the coder results. The results of the combined primary researcher and combined coder data was consolidated on one chart (sorted by ARR), and displays the percent agreement between the primary researcher and the coder(s) for each article. This comprehensive primary-coder percent agreement chart

resulted in an average raw percent agreement of 63%, and an average adjusted percent agreement of 86%. These scores indicates that amongst the primary researcher and all four coders, each article was coded with the same key issues 63% of the time, and ratings varied by only one point 86% of the time.

Article #	Coder #	Raw PA (w/Pri)	Adj PA (w/Pri)	ARR
35	Pri			54
	2	0.50	0.81	40
	4	0.47	0.77	30
34	Pri			52
	1	0.47	0.79	22
	3	0.47	0.81	51
3	Pri			41
	2	0.47	0.70	61
	4	0.66	0.79	27
28	Pri			41
	1	0.58	0.87	27
	3	0.54	0.87	39
29	Pri			40
	3	0.43	0.85	24
	4	0.52	0.87	14
30	Pri			39
	1	0.56	0.77	18
26	Pri			38
	2	0.54	0.89	33
33	Pri			37
	3	0.47	0.81	32
22	Pri			36
	4	0.60	0.81	12
25	Pri			34
	1	0.68	0.79	17
32	Pri			34
	2	0.54	0.72	47
10	Pri			33
	3	0.52	0.83	38
23	Pri			32
	4	0.56	0.79	26
24	Pri			29
	1	0.64	0.85	22
9	Pri			28
	2	0.71	0.98	29
2	Pri			27
	3	0.50	0.85	45
6	Pri			27
	4	0.58	0.85	31
7	Pri			26
	1	0.68	0.85	37
8	Pri			25
	2	0.66	0.89	36
14	Pri			25
	3	0.37	0.79	33
12	Pri			24
	4	0.77	0.91	13
1	Pri			20
	1	0.72	0.91	33
16	Pri			20
	2	0.79	0.93	23
17	Pri			20
	3	0.66	0.93	20
18	Pri			20
	4	0.77	0.81	16
20	Pri			19
	1	0.72	0.89	25
13	Pri			18
	2	0.70	0.91	26
31	Pri			18
	3	0.68	0.87	25
4	Pri			17
	4	0.68	0.91	15
27	Pri			17
	1	0.81	0.91	9
15	Pri			16
	2	0.66	0.83	36
19	Pri			13
	3	0.70	0.95	22
5	Pri			9
	4	0.85	0.95	12
11	Pri			8
	1	0.87	0.93	11
21	Pri			8
	2	0.77	0.98	15

Average PA (Raw)
all 35 articles: **63**

Average PA (Adj)
all 35 articles: **86**

Figure 4.14 Combined Primary Researcher-Combined Coder Percent Agreement (ranked by IR)

Once again, the first 12 key issues (top 25%) appeared to be the most significant by constituting about 55% (1119) of the Total Cumulative IR for combined primary-combined coder ratings for all the key issues (2037), as noted in Figure 4.15 below.

In addition, the first 4 key issues (the top 8%) showed major significance by consisting of 27% (546) of the Total Cumulative IR. Since these first 12 issues seem to carry the most weight, their results are compared separately from the rest on a pie chart (by IR) in Figures 4.16 and 4.17 (on page 66).

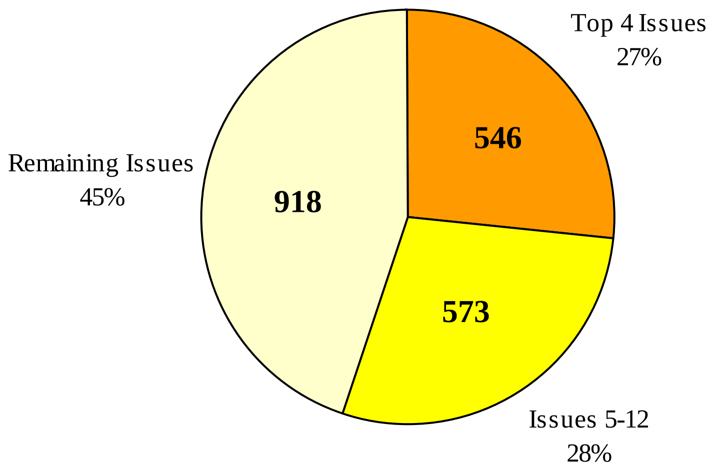

Figure 4.15 Top 25% Cumulative Key Issues Rankings

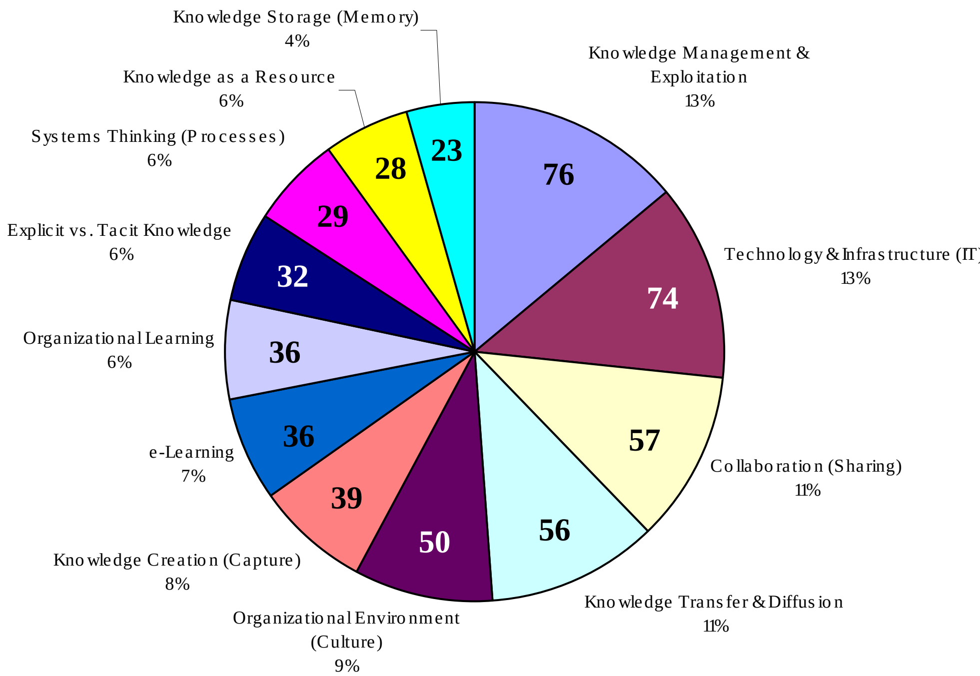

Figure 4.16 Top 12 Issue Rating Distribution (Primary & Combined Coders)

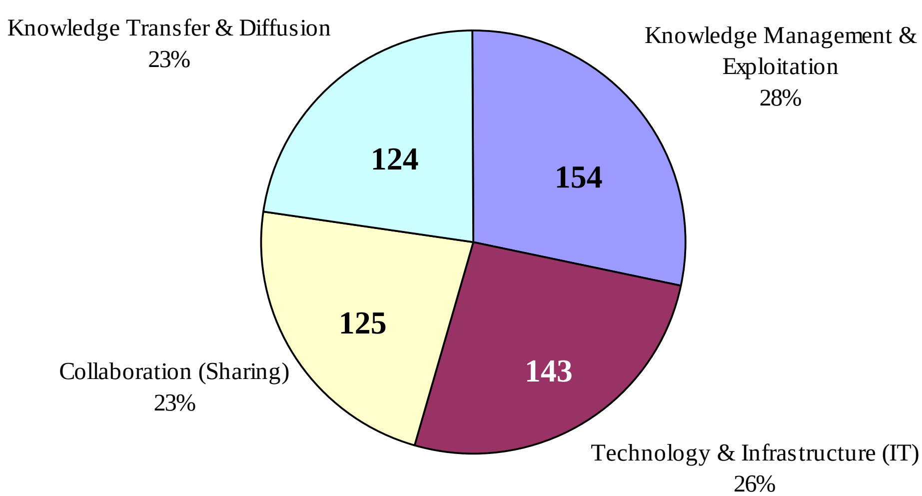

Figure 4.17 Top 4 Key Issue Ratings Distribution (Primary & Combined Coders)

The combined results of the coding sessions indicate that knowledge management and exploitation, technology and infrastructure, collaboration and sharing, and knowledge transfer and diffusion, organizational environment (culture), knowledge creation

(capture), e-Learning, organizational learning, explicit vs. tacit knowledge, systems thinking (processes), knowledge as a resource, and knowledge storage (memory) are the 12 highest-ranking key issues and should be considered the most pertinent. In addition, more emphasis should be placed on the first 4 key issues as they account for over 25% (546) of the Total Cumulative IR for combined primary-combined coder ratings for all the key issues (2037), as noted in Figure 4.15 (on page 65).

It is interesting to note that the lowest ranked key issues are all educational issues, see Figure 4.13 (on page 60). The top 12 key issues appear to deal with different aspects of KM, while the bottom 12 key issues appear to deal with educational aspects, possibly indicating a lack of educational input and theory in the literature addressing the application of KM to education. Since there appears to be some relevance here, these bottom 12 key issue results are analyzed one step further by directly comparing the key issue results of the primary researcher (Figure 4.1, on page 52) to the key issue results of the combined coders (Figure 4.6, on page 56) using Figure 4.18 below.

Issue Rank	*Primary Researcher Key Issue*	*Issue Rating*	*Issue Rank*	*Combined Coders Key Issue*	*Issue Rating*
37	Assessing Learning	7	***37***	Storytelling	9
38	Student Retention	6	***38***	Interactivity	8
39	Group (Cooperative) Learning	6	***39***	Learn by Problem Solving	8
40	Adapted Learning (Improving Efficiency)	6	***40***	Training & Teaching Time	7
41	Training & Teaching Time	5	***41***	Using Lessons Learned	7
42	Establish Goals & Priorities	5	***42***	Visual Learning	7
43	Using Lessons Learned	4	***43***	Data & Information Standardization	5
44	Just in Time Training	4	***44***	Just in Time Training	5
45	Visual Learning	3	***45***	Core Competence Building	4
46	Learn by Problem Solving	3	***46***	Education vs. Training	4
47	Distributed Learning	3	***47***	Learn by New Ideas (Generative)	3
48	Education vs. Training	2	***48***	Student Retention	2

Figure 4.18 Primary Researcher & Combined Coder Bottom 12 Key Issues (ranked by IR)

As can be seen from Figure 4.18 (on page 64), one key issue (dark highlighted) was ranked the same for both the primary researcher and the combined coders. In addition, six other key issues (light highlighted) were mentioned in both coded results, but were ranked differently. From the comparison above it's clear that there is some agreement between the primary researcher and the combined coder ratings for these lowest ranked key issues. This agreement seems to indicate a gap in the current literature dealing with the education aspect of the application of KM to education. This gap illustrates the strong need for further research in these areas.

Answers to Research Questions

Referring back to the three investigative questions for this study, the results of this data can be applied to answer these questions:

1. What does the literature identify as the key issues in the application of KM concepts education?

2. Which of these KM issues appear to have the most relevance for application in education?

3. Which KM issues appear to have the least relevance for application in education?

Although quite lengthy, the Combined Primary Researcher-Combined Coder chart (see Figure 4.13 on page 63), directly answers these research questions through its content and ranking of the key issues discovered through this content analysis. All the issues listed on this chart were identified by intensive review of current literature, and was coded by five separate researchers as key to the application of KM to education.

The content of Figure 4.13 (on page 63) answers the first question through its identification of these 48 key issues. Each of these issues listed on Figure 4.13, was identified in the applicable literature as pertinent to the application of KM in education. These key issues are ranked as to their level of emphasis in the literature using a combined Issue Rating. Higher ratings indicate more mention or discussion in the reviewed literature. Some issues were barely mentioned, while other were discussed in almost every article in the data set.

While the Issue Rating shows the overall strength of emphasis for each key issue, it does not tell us the distribution of ratings for each issue. Figure 4.19 (on page 70) expands Figure 4.13 by showing the distribution of ratings for each key issue. The distribution of the "4" ratings (the key idea of each article) vary slightly when compared to the Issue Rating order, but the largest percentage of "4" ratings is still within the top 12 key issues. Higher percentages for the "4" and "3" ratings signify deeper discussion of those topics, while higher percentages for the "2" and "1" ratings show less emphasis of the applicable issue. It is interesting to note that the topics with a higher Total Issue Rating tend to have a more even distribution of the individual ratings. Regardless of rating, all of the key issues listed on Figure 4.19 (on page 70) are indicative of what the current literature identifies as important when applying KM to education.

Issue Rank	*Preliminary Key Issue*	*Issue Rating*	*Aver Rating*	*Percent of Total Issue Rating*			
				"4" Rating	*"3" Rating*	*"2" Rating*	*"1" Rating*
1	Knowledge Management & Exploitation	154	2.52	31%	18%	23%	28%
2	Technology & Infrastructure (IT)	143	2.47	21%	31%	22%	26%
3	Collaboration (Sharing)	125	2.08	7%	20%	46%	28%
4	Knowledge Transfer & Diffusion	124	2.00	3%	23%	45%	29%
5	Organizational Environment (Culture)	100	1.68	4%	16%	24%	56%
6	Knowledge Creation (Capture)	84	1.92	0%	25%	42%	33%
7	e-Learning	76	1.76	3%	22%	22%	54%
8	Organizational Learning	70	2.64	31%	21%	28%	21%
9	Explicit vs. Tacit Knowledge	66	1.48	0%	13%	23%	63%
10	Systems Thinking (Processes)	64	1.49	2%	5%	33%	60%
11	Knowledge as a Resource	63	1.89	3%	20%	40%	37%
12	Knowledge Storage (Memory)	50	1.51	0%	9%	33%	58%
13	Continuous Improvement & Learning	48	1.68	0%	18%	32%	50%
14	Knowledge Mapping (Identification)	45	1.95	11%	17%	28%	44%
15	Individual Learning Ability	45	1.55	0%	7%	41%	52%
16	Trust (in Sharing)	42	1.76	12%	12%	15%	62%
17	KM Strategy	41	1.67	0%	19%	29%	52%
18	Knowledge Community (COP)	40	1.81	5%	5%	55%	36%
19	Management Support (Leadership)	39	1.92	4%	28%	24%	44%
20	Traditional Structured Learning	38	1.64	4%	4%	44%	48%
21	Interactivity	37	1.73	9%	5%	36%	50%
22	Organizational Structure	36	2.01	17%	11%	28%	44%
25	Knowledge Conversion (Spiral)	30	1.91	13%	13%	25%	50%
26	Reflection (Feedback)	29	1.30	0%	6%	18%	76%
27	Incentive Based Motivation	26	1.63	0%	17%	28%	56%
28	Process Integration	25	1.67	0%	17%	33%	50%
29	Knowledge Requirement (Gap Analysis)	24	2.09	0%	27%	55%	18%
30	Group (Cooperative) Learning	24	1.41	0%	8%	25%	67%
31	Affecting Behavior Change	24	1.87	6%	19%	31%	44%
32	Learn by Doing (Simulation)	23	1.52	0%	13%	25%	63%
33	Adapted Learning (Improving Efficiency)	23	1.58	0%	13%	33%	53%
34	Core Competence Building	22	1.47	0%	6%	35%	59%
35	Mentoring (for Training)	20	1.22	0%	0%	22%	78%
36	Distributed Learning	20	1.77	11%	22%	0%	67%
37	Assessing Learning	20	1.80	9%	9%	36%	45%
38	Establish Goals & Priorities	17	1.35	0%	5%	26%	68%
39	Data & Information Standardization	17	2.20	11%	33%	22%	33%
40	Storytelling	16	1.52	0%	17%	17%	67%
41	Using Lessons Learned	13	1.84	0%	15%	54%	31%
42	Training & Teaching Time	13	1.75	0%	15%	46%	38%
43	Learn by Problem Solving	11	1.44	0%	11%	22%	67%
44	Learn by New Ideas (Generative)	11	1.41	0%	8%	25%	67%
45	Visual Learning	10	1.44	0%	0%	44%	56%
46	Student Retention	9	1.29	0%	0%	29%	71%
47	Just in Time Training	9	1.43	0%	0%	43%	57%
48	Education vs. Training	6	2.20	0%	60%	0%	40%

Figure 4.19 Comprehensive Issue Rating Distribution (ranked by IR)

The ranking of these key issues on Figure 4.13 (on page 63) also answers the second question. Although it is important to identify all the issues that appear to be pertinent to the application of KM in education, it is also critical to know which of these issues are the most applicable. It would be very difficult to create a KM system for any organization that could take into account all 48 key issues discovered with this research. Thus, it becomes important to identify which of these 48 key issues are considered the most important. The top 12 issues on Figure 4.13 (on page 63) constitute just over 50% of the total cumulative IR, meaning that these 12 issues (combined) were identified in the literature more often than the ratings of all the other key issues combined. These top 12 issues also contain the highest concentration of "4" ratings as shown by Figure 4.19 (on page 70), illustrating the depth of discussion regarding these important issues. It is apparent that these issues are considered the most applicable by the literature and should be considered the most important when applying KM to education. An excerpt for Figure 4.13 listing these top12 issues is shown in Figure 4.20 below.

Issue Rank	*Preliminary Key Issue*	*Issue Rating*	*Issue Rank*	*Preliminary Key Issue*	*Issue Rating*
1	Knowledge Management & Exploitation	154	***7***	e-Learning	76
2	Technology & Infrastructure (IT)	143	***8***	Organizational Learning	70
3	Collaboration (Sharing)	125	***9***	Explicit vs. Tacit Knowledge	66
4	Knowledge Transfer & Diffusion	124	***10***	Systems Thinking (Processes)	64
5	Organizational Environment (Culture)	100	***11***	Knowledge as a Resource	63
6	Knowledge Creation (Capture)	84	***12***	Knowledge Storage (Memory)	50

Figure 4.20 Top 12 Combined Primary Researcher-Combined Coder Key Issues (ranked by IR)

The third and final question is answered by examining the bottom of Figure 4.13 (on page 63). These lowest ranked key issues (the bottom 48 issues), were identified as having the least amount of impact on the application of KM to education (as derived from

current literature). From the low issue ratings for these issues, they were either mentioned only in passing or in only one or two articles. When analyzing these results, it must be noted that further research may uncover further key issues that could not be discovered with this research methodology.

Issue Rank	Preliminary Key Issue	Issue Rating
1	Knowledge Management & Exploitation	154
2	Technology & Infrastructure (IT)	143
3	Collaboration (Sharing)	125
4	Knowledge Transfer & Diffusion	124
5	Organizational Environment (Culture)	100
6	Knowledge Creation (Capture)	84
7	e-Learning	76
8	Organizational Learning	70
9	Explicit vs. Tacit Knowledge	66
10	Systems Thinking (Processes)	64
11	Knowledge as a Resource	63
12	Knowledge Storage (Memory)	50

Issue Rank	Preliminary Key Issue	Issue Rating
37	Assessing Learning	20
38	Establish Goals & Priorities	17
39	Data & Information Standardization	17
40	Storytelling	16
41	Using Lessons Learned	13
42	Training & Teaching Time	13
43	Learn by Problem Solving	11
44	Learn by New Ideas (Generative)	11
45	Visual Learning	10
46	Student Retention	9
47	Just in Time Training	9
48	Education vs. Training	6

Figure 4.21 Combined Primary Researcher-Combined Coder Top 12 & Bottom 12 Key Issues (ranked by IR)

V. Conclusions & Recommendations

Introduction

In the business world of today, decisions are made faster than even before, and the success of an organization often rests on its ability to correctly make these decisions (Nonaka, 1996). Coupled with the ability of modern computers, this shift in the speed of decision-making has made knowledge the most valuable resource, giving rise to a new concept called knowledge management (Hansen, 1999).

The academic world has long since identified this trend and have been exhorting the benefits of knowledge management (KM) and how it can benefit an organization Davenport & Prusak, 1998). Unfortunately, few in the academic world are applying KM techniques to their processes. The academic world preaches of the value of KM, but yet fails to use it in their academic setting (Oliver, 2003).

Due to this lack of attention, very little research has been done in the application of KM in education. As knowledge is crucial for organizational growth and success, it is vital that our educational institutions embrace the application of KM methods in their daily processes to ensure their own success. This is especially important considering the rigid culture that often grows with an educational organization. Unfortunately, there are no models or examples to analyze for KM application or use, and what little information can be found about KM in education yields contradictory opinions. This lack of agreement on even the most basic of issues dictates the establishment of these key issues before any further research can be performed (Creswell, 1994).

Discussion

Given the lack of research in this field, the objective of this research was to establish the key issues in the application of knowledge management (KM) in education, in order to form a foundation for future research. After a lengthy search and review of background literature and definitions available for this study, three main research questions were developed to meet this objective, as stated below.

1. What does the literature identify as the key issues in the application of KM concepts education?

2. Which of these KM issues appear to have the most relevance for application in education?

3. Which KM issues appear to have the least relevance for application in education?

These questions were answered using a content analysis of available literature relating to KM and education, learning, and training. This search of available literature yielded 35 articles for review. Five researchers were used to analyze these documents and note which issues were being discussed, resulting in the following list.

1	Knowledge Mgmt & Exploitation	*17*	KM Strategy	*33*	Adapted Learning (Imp Efficiency)
2	Technology & Infrastructure (IT)	*18*	Knowledge Community (COP)	*34*	Core Competence Building
3	Collaboration (Sharing)	*19*	Mgmt Support (Leadership)	*35*	Mentoring (for Training)
4	Knowledge Transfer & Diffusion	*20*	Traditional Structured Learning	*36*	Distributed Learning
5	Org Environment (Culture)	*21*	Interactivity	*37*	Assessing Learning
6	Knowledge Creation (Capture)	*22*	Organizational Structure	*38*	Establish Goals & Priorities
7	e-Learning	*23*	Student Centered (Personalized)	*39*	Data & Information Standards
8	Organizational Learning	*24*	Knowledge Measurement	*40*	Storytelling
9	Explicit vs. Tacit Knowledge	*25*	Knowledge Conversion (Spiral)	*41*	Using Lessons Learned
10	Systems Thinking (Processes)	*26*	Reflection (Feedback)	*42*	Training & Teaching Time
11	Knowledge as a Resource	*27*	Incentive Based Motivation	*43*	Learn by Problem Solving
12	Knowledge Storage (Memory)	*28*	Process Integration	*44*	Learn by New Ideas (Generative)
13	Continuous Imp & Learning	*29*	Knowledge Req (Gap Analysis)	*45*	Visual Learning
14	Knowledge Mapping (ID)	*30*	Group (Cooperative) Learning	*46*	Student Retention
15	Individual Learning Ability	*31*	Affecting Behavior Change	*47*	Just in Time Training
16	Trust (in Sharing)	*32*	Learn by Doing (Simulation)	*48*	Education vs. Training

Figure 5.1 48 Key Issues in the Application of KM in Education (in order of frequency).

These 48 key issues are ranked by a measure of their frequency of mention across all 35 articles in the data set. The higher as issue is on the list, the more it was defined and discussed in the applicable literature. The literature identifies these 48 issues as having some measure of impact when considering the application of KM in an educational environment, with the top 12 issues having the most importance.

It was noted that the top 12 key issues all pertain to KM and the bottom 12 all pertain to education, training, or learning. This disparity illustrates a gap in the current literature as to the discussion of KM in education. It appears the educational aspects of applying KM to education are not being discussed or acknowledged in the current literature. This could be due to the low amount of research on this topic, or perhaps due to improper interpretation or application of KM concepts and techniques. Regardless, more research needs to be performed to discover why this gap exists.

Research Limitations

In this research, there were three limiting factors that can affect the results of this work: researcher bias, article selection, and coder training.

Researcher Bias

As with all qualitative research, the researcher is the key instrument in the study (Leedy, 2001). Much of the analysis depends on the ability and skill of the researcher, thus researcher bias can drastically affect a study's results. Bias can influence the results in many ways including: researcher background, previous knowledge, personal

predispositions, researcher skill, and competency (Leedy, 2001). Since all of the researchers (primary and otherwise) are key to this study, there is no method to completely remove all possible bias. To minimize this effect, all researchers in the study were briefed of these concerns and reminded to take them into consideration when performing their analysis. All efforts were made to reduce the amount of researcher opinion in the analysis process when possible.

Article Selection

There was no way of completely capturing every known piece of written material concerning the application of KM in education. Thus, a sample was obtained from this population using objective search criteria. There was no way to ascertain for certain whether or not this sample incorporates all the key issues or is representative of the population. This issue must be taken into account when drawing conclusions from these results (Leedy, 2001).

As mentioned above, objective search criteria were used in this sampling to reduce researcher input. This criterion was developed after some initial research into the application of KM in education, and was evaluated for is applicability to the topic of research. Once again, researcher input was needed here to decide on the validity of the search criteria and its applicability to the study, thus there is the possibility for bias in the selection of the search criteria. Further researcher bias was minimized in the sampling process by using only the objective search criteria to select the sample articles; no other researcher input was made in the sampling process.

Coder Training

The intercoder reliability of 0.57 is acceptable for this study, but is still considered low by some academic standards (Neuendorf, 2002). If all researchers were given the same training, then they all should be using the same standards and thus code the samples in the same fashion, resulting in a higher intercoder reliability score (> 0.70). This lower score may be an indicator of insufficient training, but two other factors may account for this low intercoder reliability, as noted below.

First, the sheer number of articles (35) and key issues (48) left a lot of room for error in the coding. Each key issue was defined as precisely as possible, but with 48 key issues for the coders to remember, there was plenty of room for confusion and human error. Subtle differences in researcher experience and ability could also lead to low intercoder reliability scores, as each researcher may interpret a key issue definition in a slightly different fashion. These differences in interpretation combined with the large number of key issues to evaluate can easily result in variations in coding, despite the amount of training involved.

Second, the samples used for the study were not always applicable to the application of KM in education. Articles used in this study were selected based solely on objective search criteria. As a result, some of the articles selected did not pertain to the topic of study. These articles required more judgment and evaluation from the researchers, forcing them to stray from the definitions established during their training. This use of researcher opinion and deviations from the key issue definitions naturally leads to increased variation in coding and intercoder reliability scores.

Suggestions for Further Study

It is important to note that there has been concurrent research performed for the sponsor of this research. 1Lt John Tate performed a case study analysis of Air Force Knowledge Now (AFKN) communities of practice as a form of technology that acts as a knowledge management support system; Davis' (1989) technology acceptance model was used as the basis for this study. Captain Gary Felax performed a case study analysis on the usability and accessibility of the AFKN web site. Both research theses above are to be completed and published in March 2005.

Since the research methods used in this study were very qualitative in nature, there are many avenues of research yet to be explored. First, a duplicate study of this research could be performed to verify the results obtained in this paper. Not only would this remove any bias from the researchers in this study, but could further define and clarify the key issues in the application of KM in education discovered here. A duplicate study may also lead to answers as to why no educational issues are identified in the top 12 issues found in this research.

Second, a specific study could be performed to discover why there are no education key issues in the top 12 results of this study. As a matter of fact, most of the education oriented key issues are at toward the bottom of the list. Perhaps this is due to the lack of input from educational scholars in the current literature, or lack of detailed educational systems knowledge among the researchers. Whatever the case may be, the whole purpose of this study was to establish the key issues in the application of KM in education, so why are their hardly any educational issues located among the top key

issues? Identifying the possible reasons for this gap in educational issues may lead to some new insight or conclusions not discovered in this paper.

Finally, the main reason for this research was to form the foundation for the development of a working KM model for education. Before a KM model for education could be designed, the key issues in its application need to be established to ensure the most relevant issues were taken into account by the model. Now that these key issues have been identified, a preliminary KM model can be built for application in a small, educational environment. The results from this model could lead to new or modified key issues, and might stir more interest in applying KM to education.

Summary

Information and knowledge are the keys to success for any group or organization (Drucker, 1993). The organizations that best manage their information and knowledge will outlast those who don’t (Nonaka, 1995). It is time for our educational institutions to practice what they preach and start using KM concepts and techniques within their own structures (Oliver, 2003).

This need for KM extends out into DoD and US Air Force (USAF) educational organizations. Given the important of USAF missions and their need for experty trained people, only increases their need for an educational KM model (DAF, 2003). USAF traning organizations must be able to quickly change the way they educate and teach their students, in order to meet the ever changing needs of their missions (DAF, 2003). These facts were the driving force behind this research.

The goal of this research was to establish what the current literature considered was important, or key, in the application of KM in education. Once these key issues were identified, a KM model could be designed and test for use in an educational environment. The 48 key issues discovered here will form the foundation for future research in this field, and hopefully lead to the construction and implementation of KM throughout our educational systems.

Appendix A - Articles Used in this Research

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Appendix B – Sample Codebook (Part 1 of 2)

Article # ***Author*** ***Article Date***	**34** Thorn Nov 01	**28** Raisinghani Jun 00	**30** Leitch 1996	**25** Stoffle Nov 96	**24** Petrovic 1998
Article Title	*"Knowledge Management for Educational Information Systems: What is the State of the Field?"*	*"Knowledge Management: A Cognitive Perspective on Business and Education"*	*"Learning Organizations: The Measurement of Company Performance"*	*"The Emergence of Education and Knowledge Management as Major Functions of the Digital Library"*	*"Learning Aspects of Knowledge Management nd New Technologies"*
Key Issues					
Knowledge Mgmt & Exploitation					
Technology & Infrastructure (IT)					
Collaboration (Sharing)					
Knowledge Transfer & Diffusion					
Knowledge Creation (Capture)					
Org Environment (Culture)					
Systems Thinking (Processes)					
e-Learning					
Knowledge Mapping (ID)					
Knowledge as a Resource					
Explicit vs. Tacit Knowledge					
Knowledge Storage (Memory)					
Interactivity					
Organizational Learning					
Trust (in Sharing)					
Individual Learning Ability					
Student Centered (Personalized)					
Mgmt Support (Leadership)					
Continuous Imp. & Learning					
KM Strategy					
Traditional Structured Learning					
Organzational Structure					
Knowledge Measurement					
Core Competence Building					
Reflection (Feedback)					
Knowledge Community (COP)					
Learn by Doing (Simulation)					
Data & Info Standardization					
Knowledge Conversion (Sprial)					
Knowledge Req. (Gap Analysis)					
Affecting Behavior Change					
Process Integration					
Learn by New Ideas (Generative)					
Storytelling					
Mentoring (for Training)					
Incentive Based Motivation					
Assessing Learning					
Student Retention					
Group (Cooperative) Learning					
Adapted Learning (Imp. Efficiency)					
Training & Teaching Time					
Establish Goals & Priorities					
Using Lessons Learned					
Just in Time Training					
Visual Learning					
Learn by Problem Solving					
Distributed Learning					
Education vs Training					

Appendix B – Sample Codebook (Part 2 of 2)

Article # ***Author*** ***Article Date***	**7** Swap Summer 01	**1** Oliver 2003	**20** Petrides Jul 04	**27** Gumport May 02	**11** Martin Sep 01
Article Title	*"Using Mentoring and Storytelling to Transfer Knowledge in the Workplace"*	*"Towards Understanding KM Practices in the Academic Environment: The Shoemaker's Paradox"*	*"Panning for Gold in the Data Mines"*	*"The Formal Organization of Knowledge"*	*"e-Finance: What's all the Hoopla"*
Key Issue					
Knowledge Mgmt & Exploitation					
Technology & Infrastructure (IT)					
Collaboration (Sharing)					
Knowledge Transfer & Diffusion					
Knowledge Creation (Capture)					
Org Environment (Culture)					
Systems Thinking (Processes)					
e-Learning					
Knowledge Mapping (ID)					
Knowledge as a Resource					
Explicit vs. Tacit Knowledge					
Knowledge Storage (Memory)					
Interactivity					
Organizational Learning					
Trust (in Sharing)					
Individual Learning Ability					
Student Centered (Personalized)					
Mgmt Support (Leadership)					
Continuous Imp. & Learning					
KM Strategy					
Traditional Structured Learning					
Organzational Structure					
Knowledge Measurement					
Core Competence Building					
Reflection (Feedback)					
Knowledge Community (COP)					
Learn by Doing (Simulation)					
Data & Info Standardization					
Knowledge Conversion (Sprial)					
Knowledge Req. (Gap Analysis)					
Affecting Behavior Change					
Process Integration					
Learn by New Ideas (Generative)					
Storytelling					
Mentoring (for Training)					
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Adapted Learning (Imp. Efficiency)					
Training & Teaching Time					
Establish Goals & Priorities					
Using Lessons Learned					
Just in Time Training					
Visual Learning					
Learn by Problem Solving					
Distributed Learning					
Education vs Training					

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Vita

First Lieutenant George A. Mendoza graduated from South Lake Tahoe high school in June 1989, after which he immediately enlisted in the Air Force. He began his career as an Aircraft Electrical-Environmental Systems Specialist, and in 1998 he became a Technical Training Instructor as Sheppard AFB, Texas. Highlights of his enlisted time in the Air Force include: technical school Distinguished Graduate, Airman Leadership School John Levitow Award winner, and participation in numerous exercises and real-world contingencies.

Lt Mendoza graduated Wayland Baptist University in May of 2001 with a Bachelors degree in Computer Science Technology, and was commissioned as a second lieutenant in August 2001.

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14. ABSTRACT Today's world is a fast moving place where decisions are made with an ever-increasing speed, and the success of an organization rests on its ability to correctly make these decisions. This shift in paradigms has made knowledge the key resource as organizations shift their focus from natural resources to intellectual assets, heralding the use of a concept called Knowledge Management. Despite its acceptance and use in commercial organizations, KM is not being applied in the academic world. No KM models exist for educational use, and no other studies into this topic can be found. This research establishes a foundation for future research by answering the question "What does current literature identify as the key issues in the application of KM concepts in education?" Forty-eight key issues were uncovered, each with varying levels of emphasis. Further research is required to better define these 48 issues, and to discover the cause of this educational issue gap. The key issues discovered here can also be used to build and test an actual KM model for application in an educational environment.			
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